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Hmelar et al.

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(54) **METHOD AND APPARATUS FOR KEYING INK SUPPLY CONTAINERS**

(75) Inventors: **Susan Hmelar**, Berlin (DE); **David O. Merrill**; **Glen E. Schmidt**, both of Corvallis, OR (US); **John A. Underwood**, Vancouver, WA (US); **Mark J. Green**, Sebastopol, CA (US); **Thomas Cocklin**, Ridgefield, WA (US); **Bruce Cowger**; **Norman E. Pawlowski, Jr.**, both of Corvallis, OR (US); **John A. Barinaga**, Portland, OR (US); **Charles R. Steinmetz**, Corvallis, OR (US); **Curt G. Gonzales**, Corvallis, OR (US); **John F. Wilson**, Corvallis, OR (US)

(73) Assignee: **Hewlett-Packard Company**, Palo Alto, CA (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: **09/177,144**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 08/429,915, filed on Apr. 27, 1995, now abandoned, and a continuation-in-part of application No. 08/566,521, filed on Dec. 4, 1995, now abandoned, and a continuation-in-part of application No. 08/671,134, filed on Jun. 27, 1996, now abandoned.

(51) **Int. Cl.**[7] **B41J 2/175**
(52) **U.S. Cl.** **347/86**
(58) **Field of Search** 347/49, 85, 86, 347/87

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Primary Examiner—Huan Tran
Assistant Examiner—Michael Nghiem
(74) *Attorney, Agent, or Firm*—Kevin B. Sullivan

(57) **ABSTRACT**

The present disclosure relates to an ink supply container for containing ink. The ink supply container is configured for providing ink to an ink jet printing system. The ink container includes a first feature indicative of an ink family of a plurality of ink families associated with ink contained in the container. Also included is a second feature spaced from the first feature. The second feature is indicative of an ink color of a plurality of ink colors associated with ink in the container.

26 Claims, 10 Drawing Sheets

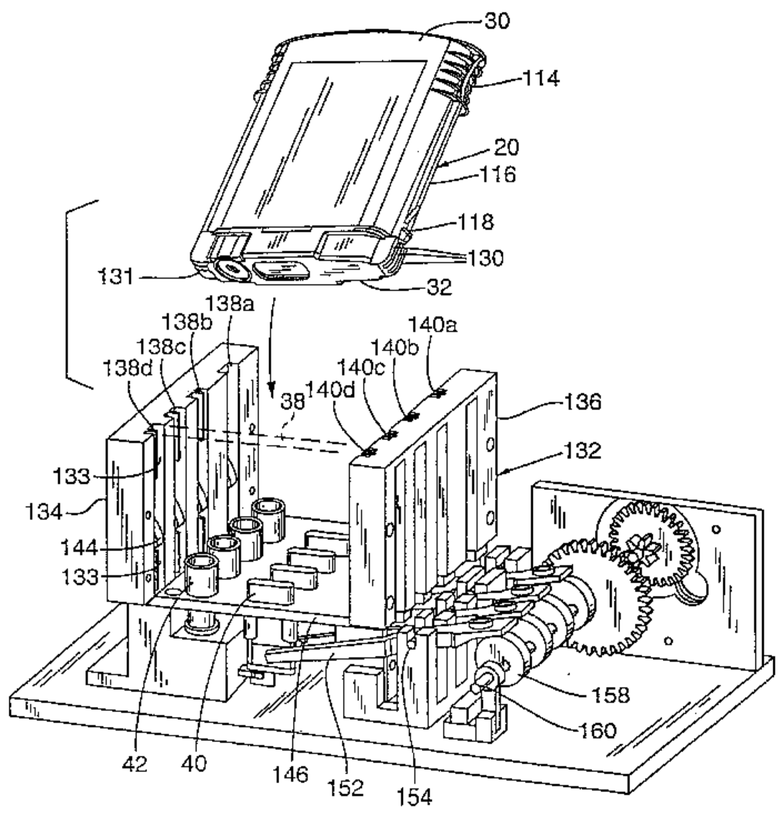

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FIG. 1

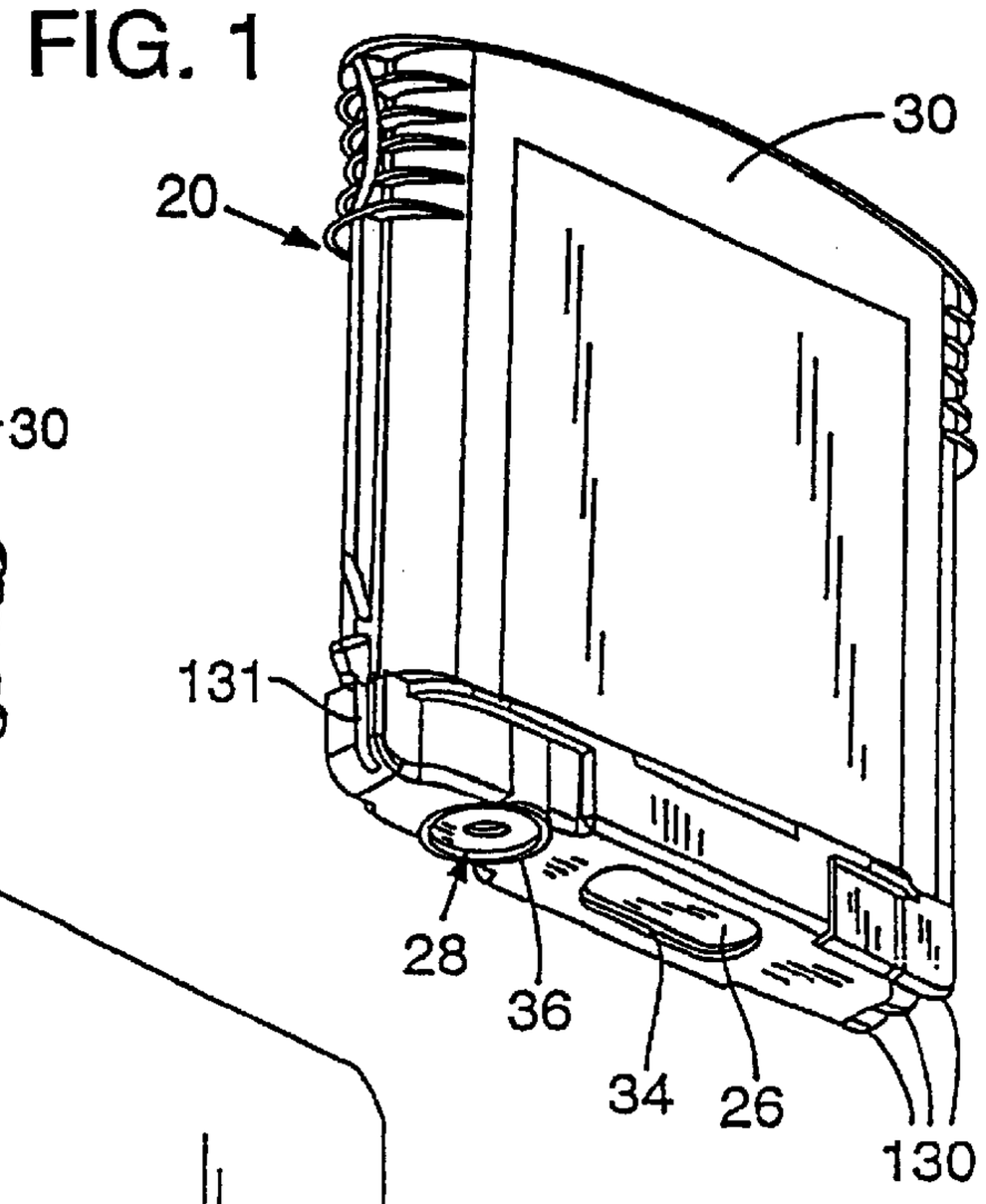
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FIG. 2

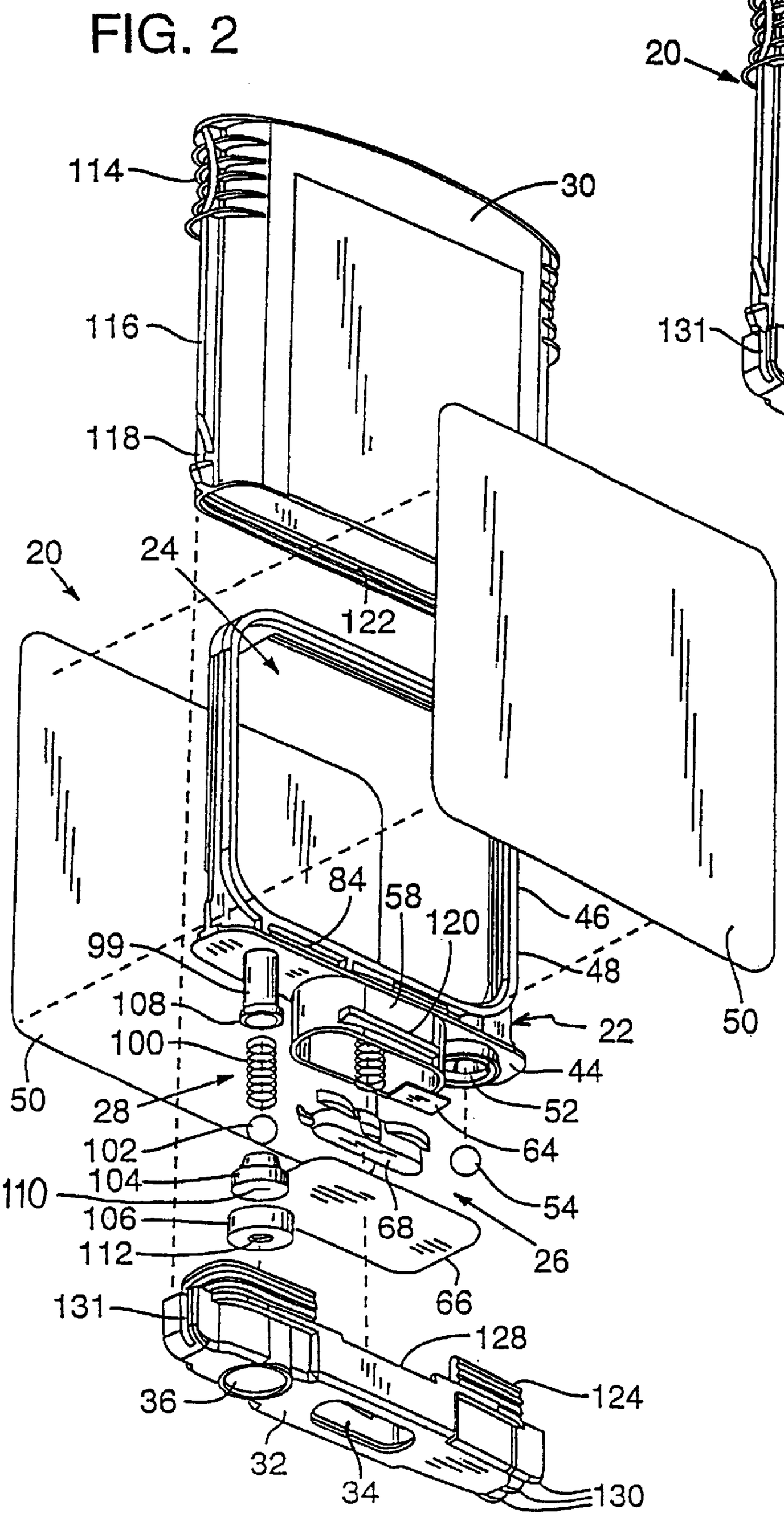
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FIG. 5

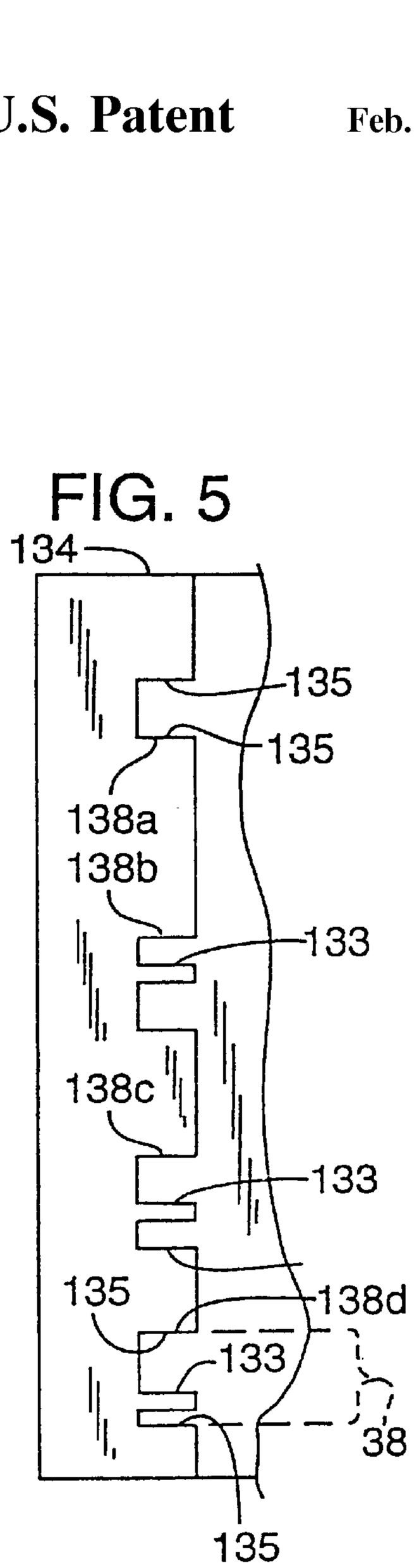


FIG. 3A

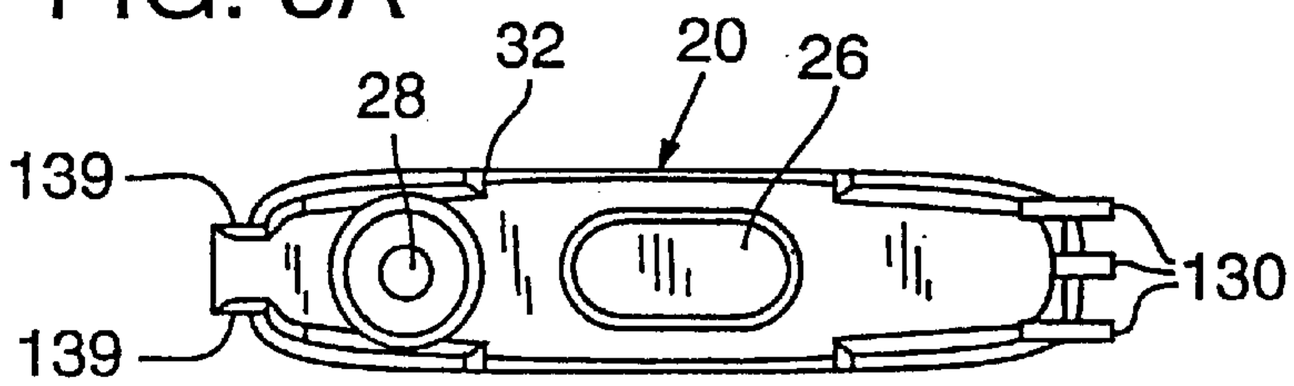


FIG. 3B

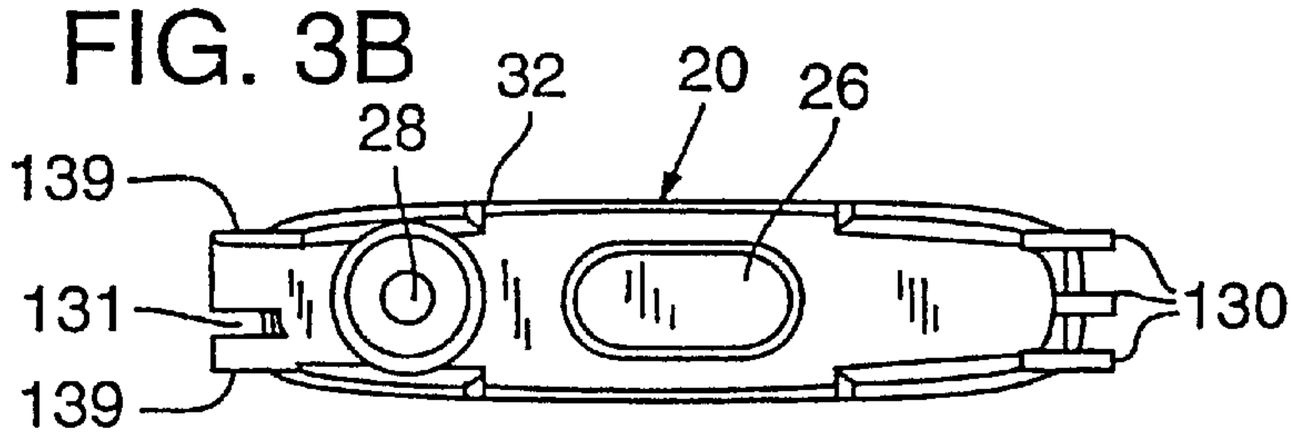


FIG. 3C

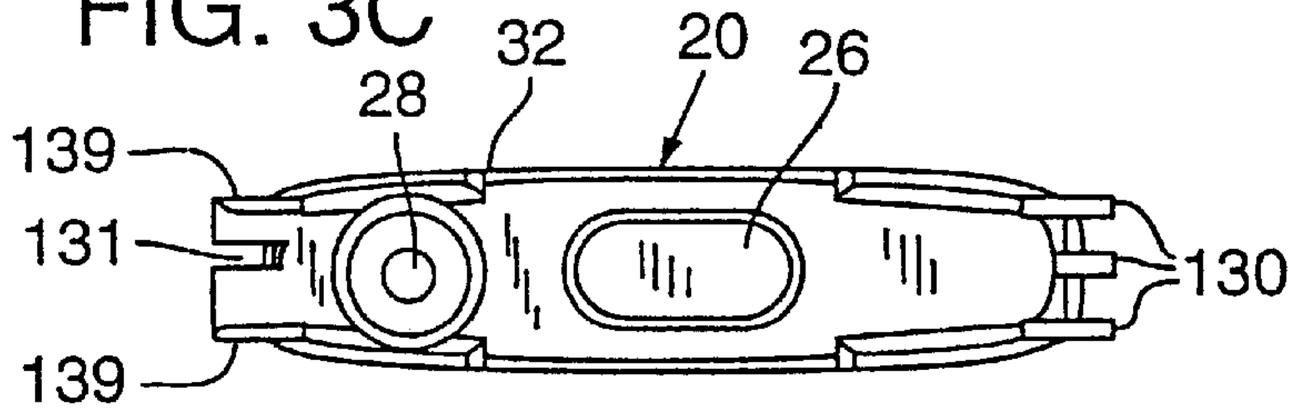
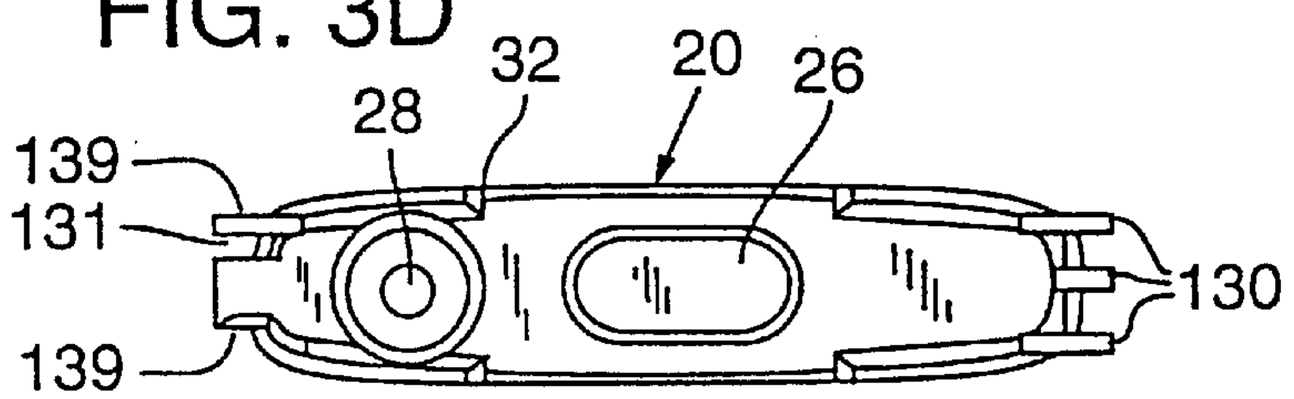
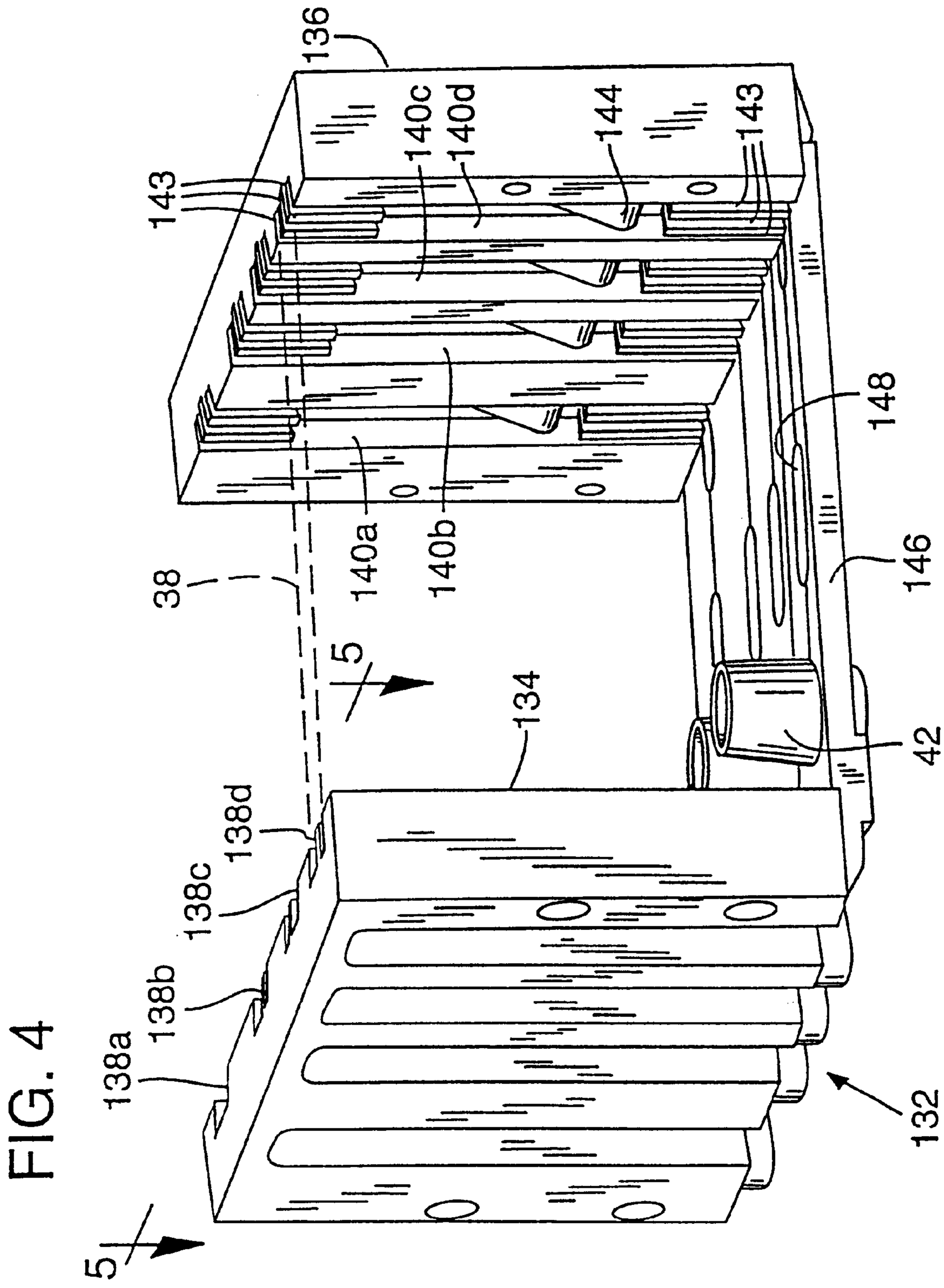


FIG. 3D

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138b
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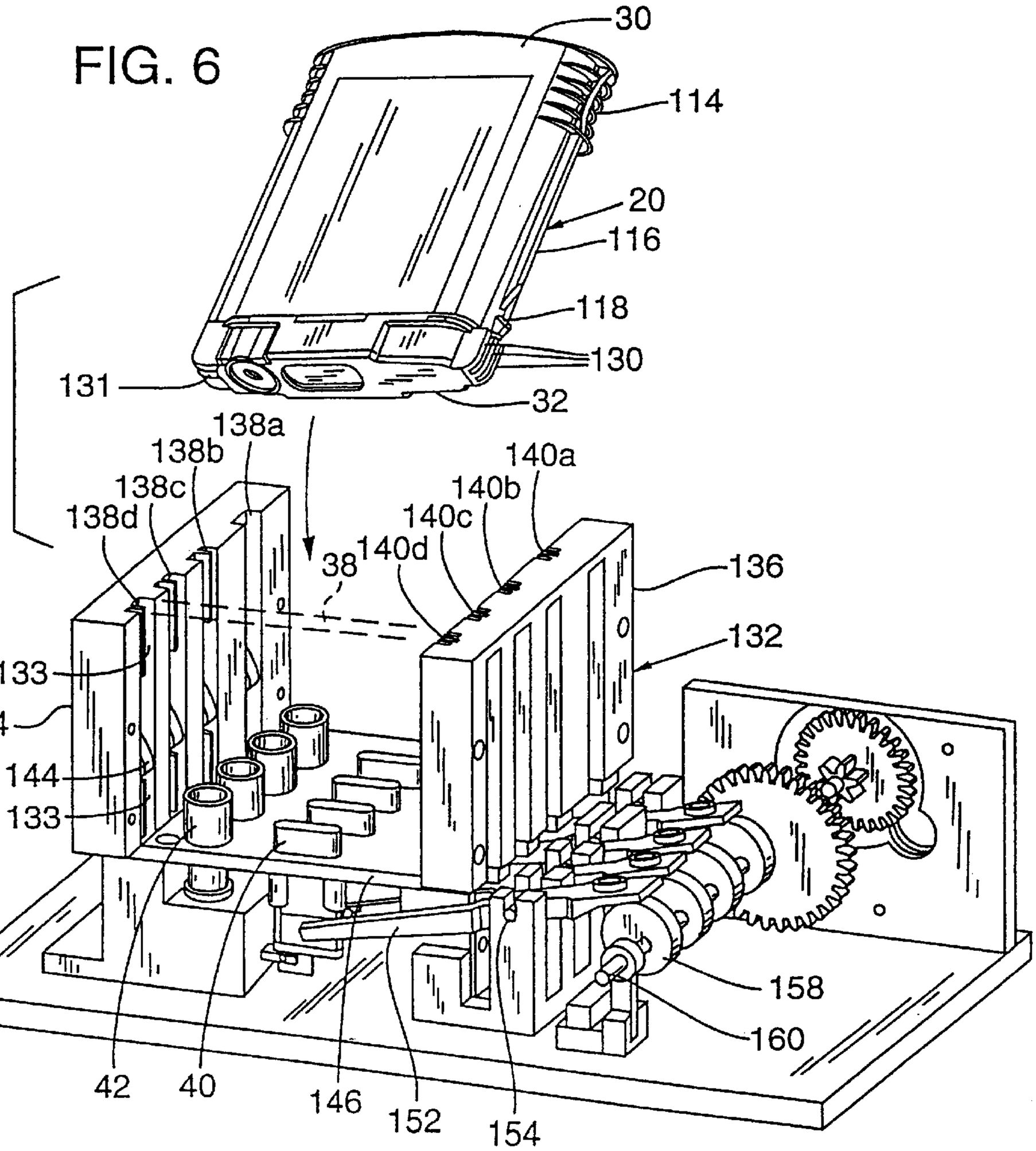
FIG. 4

FIG. 6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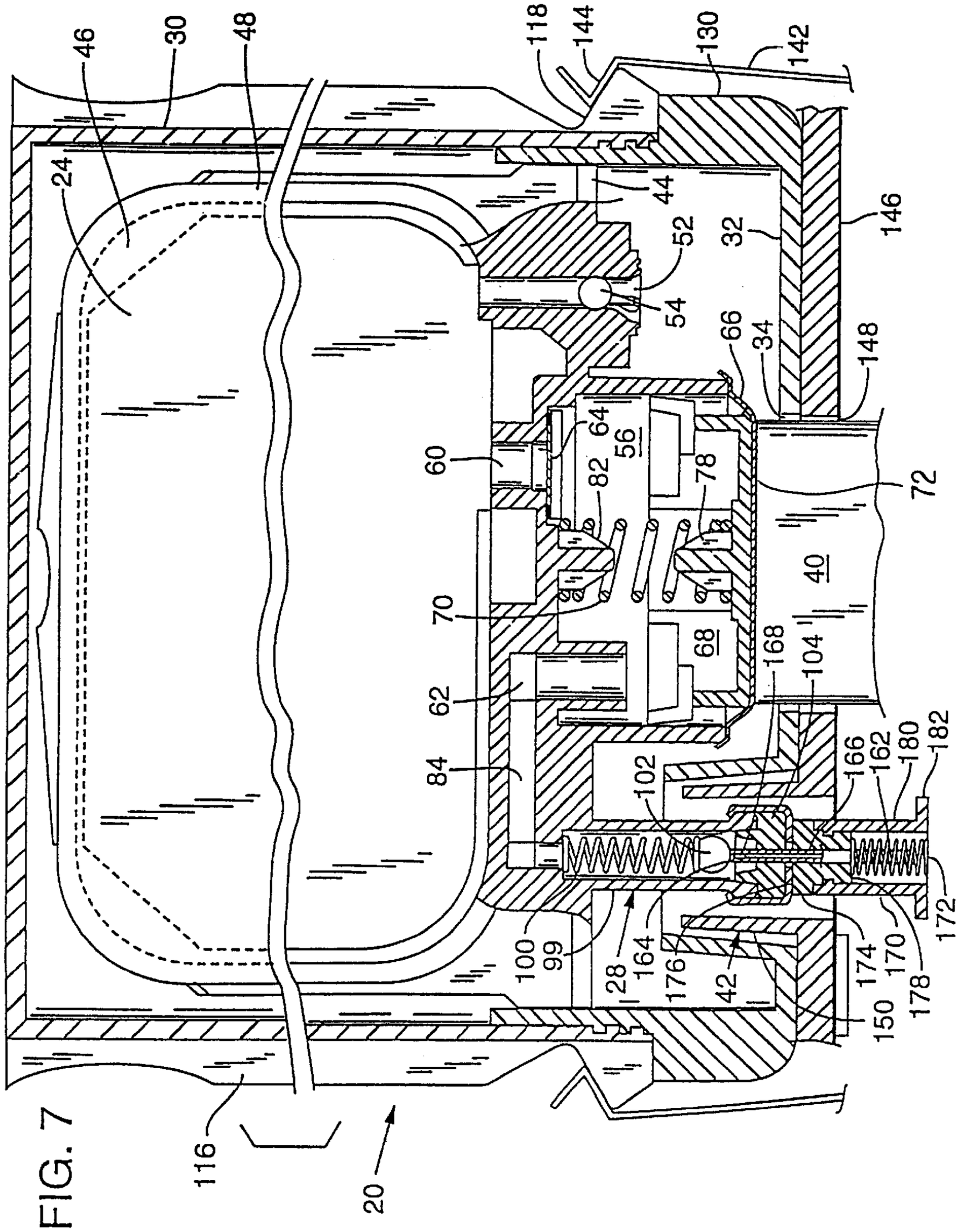
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FIG. 7

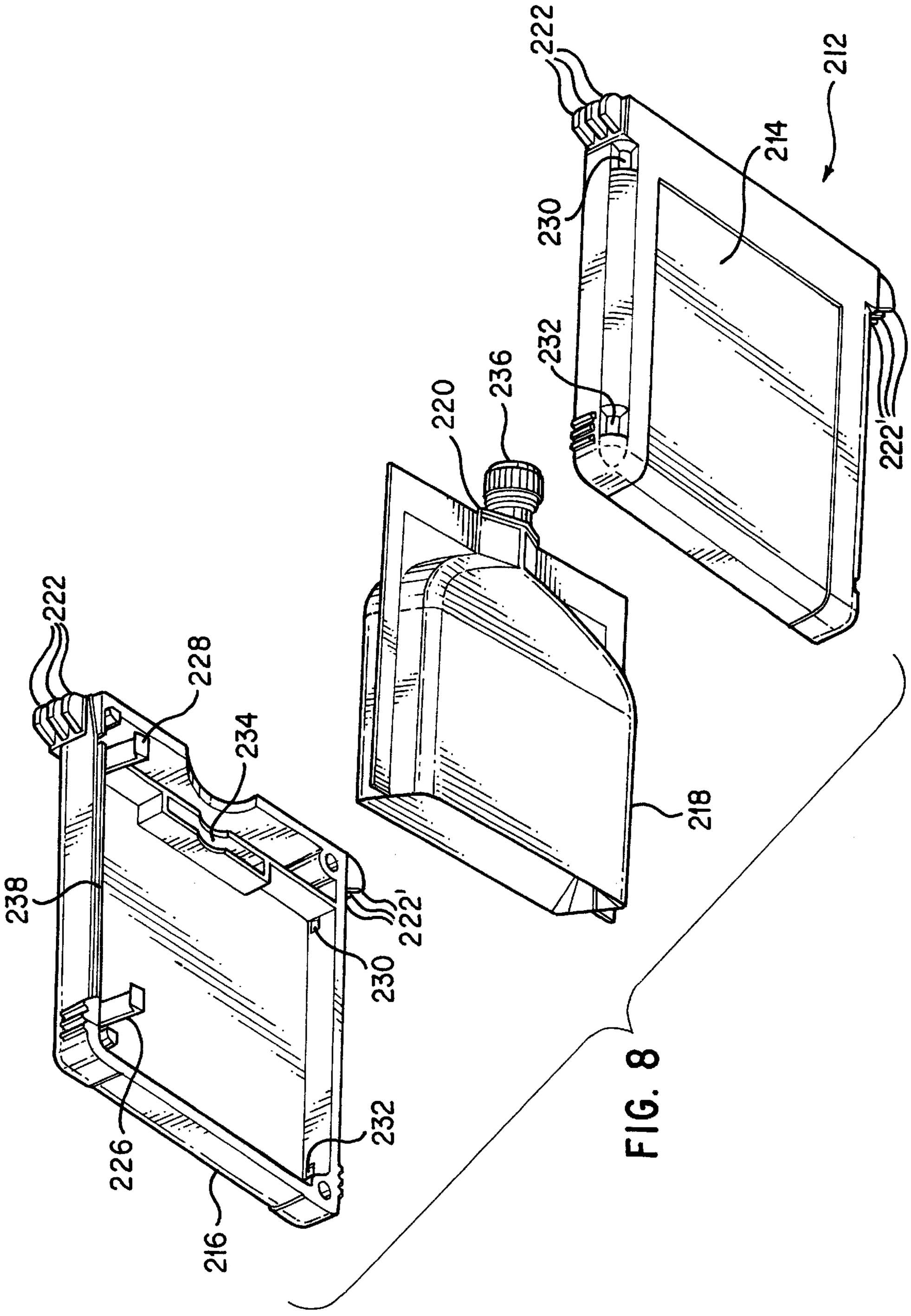

FIG. 8

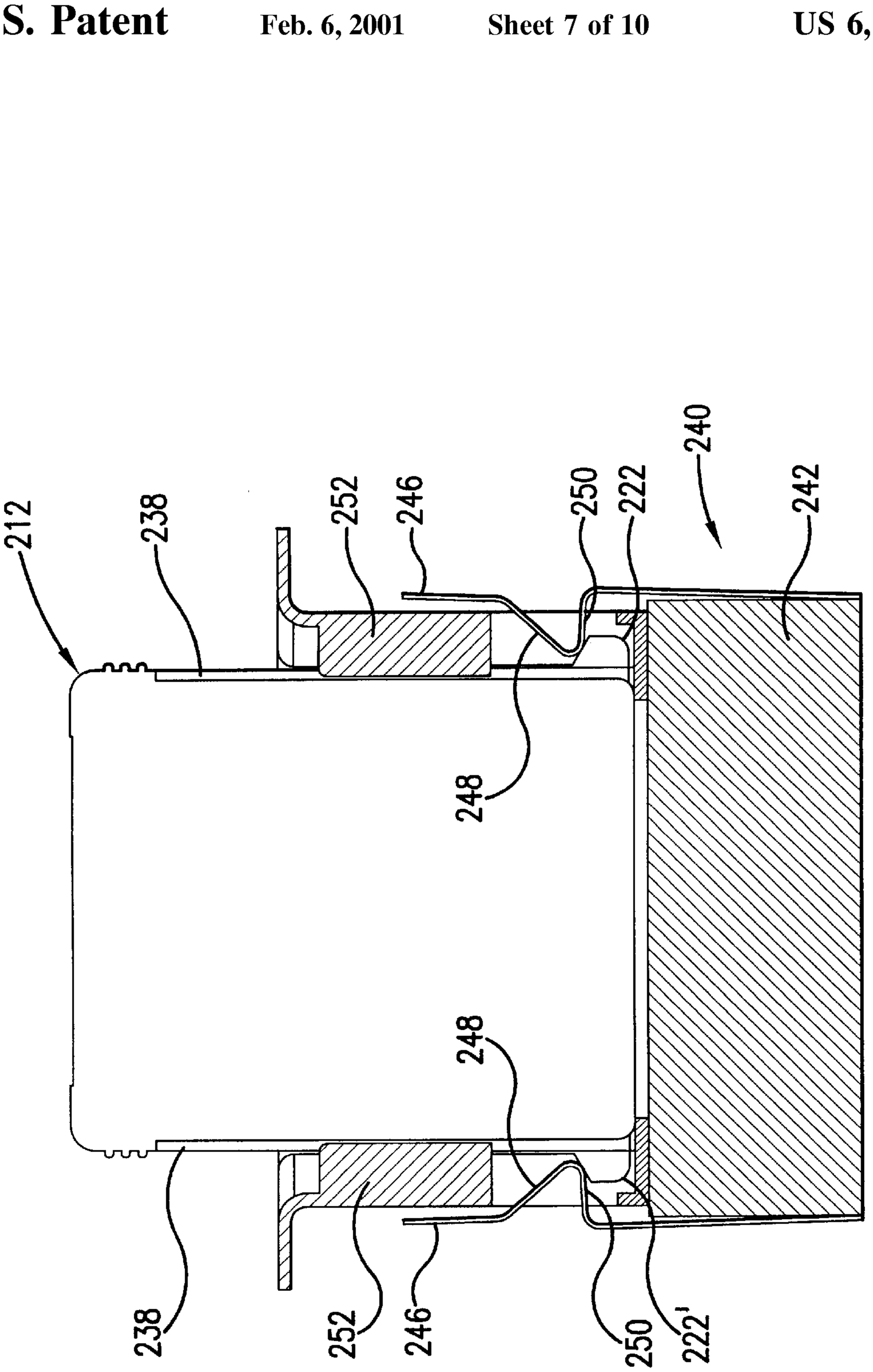

FIG.9

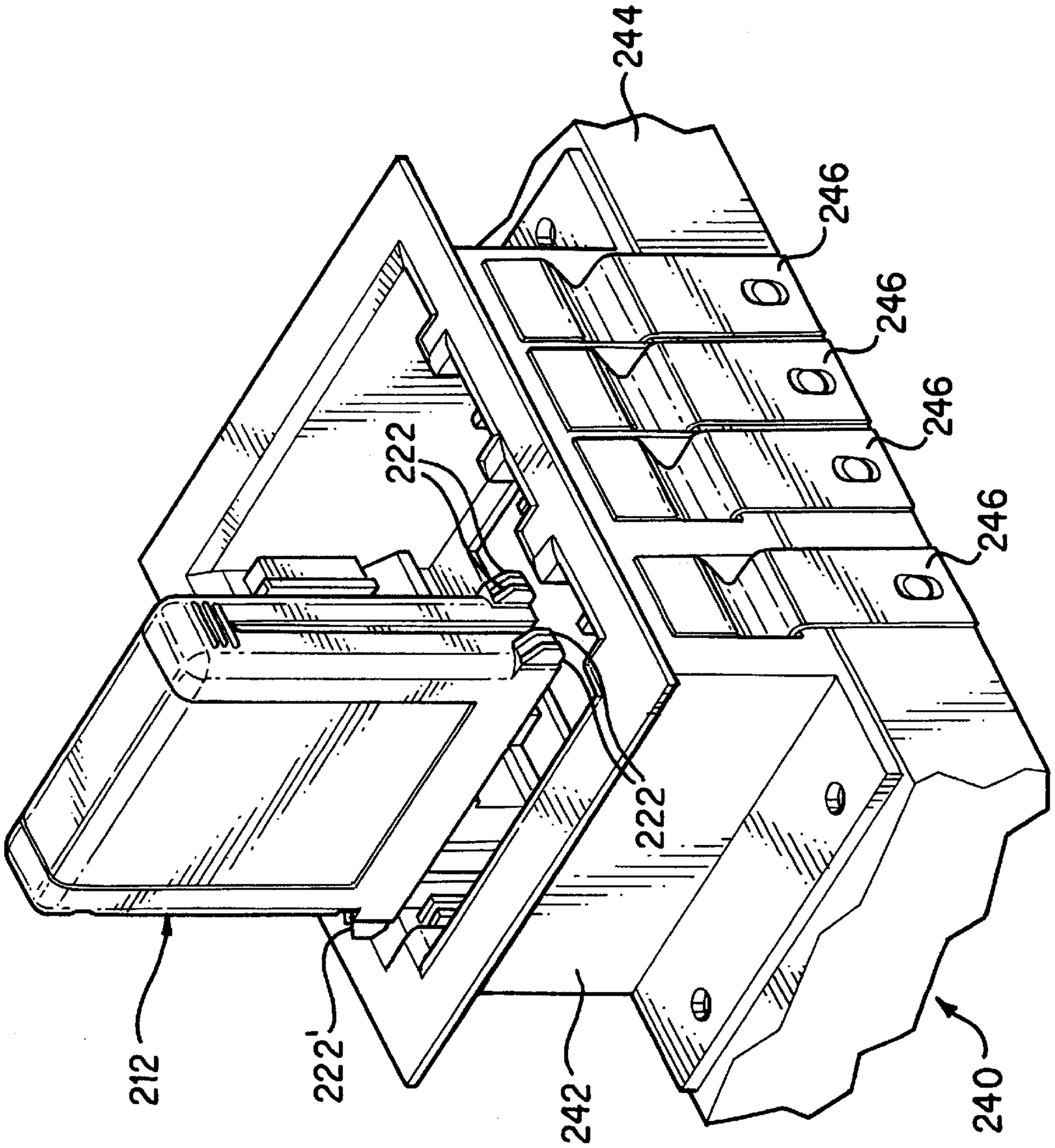

FIG. 10

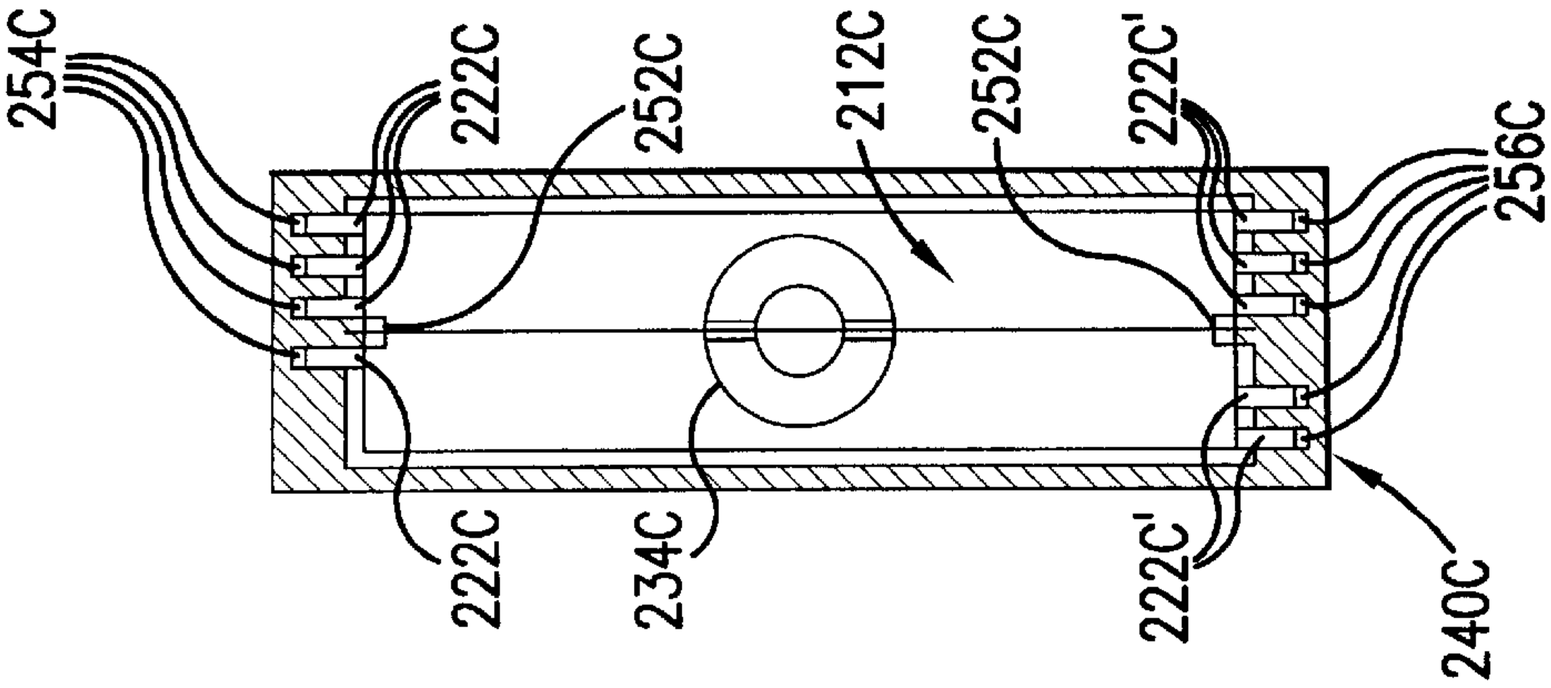

FIG. 11C

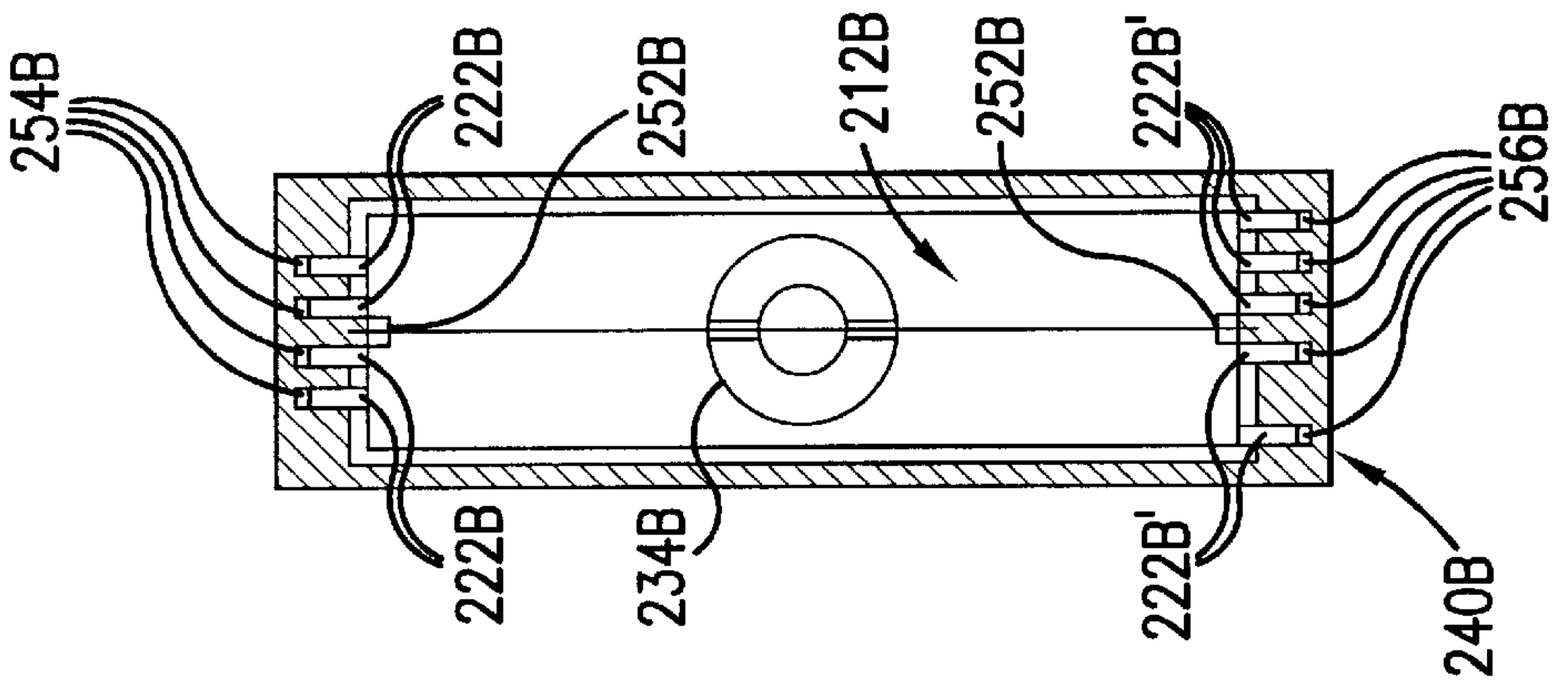

FIG. 11B

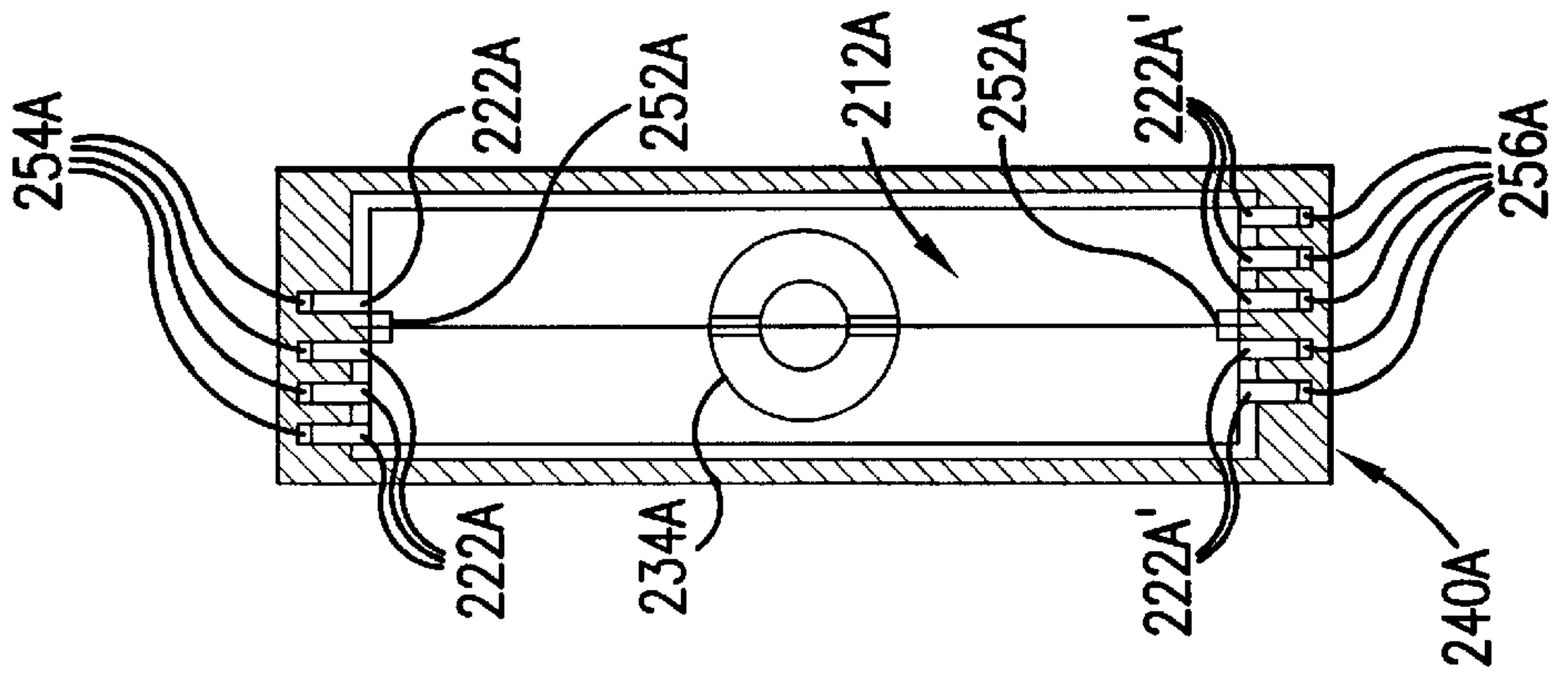

FIG. 11A

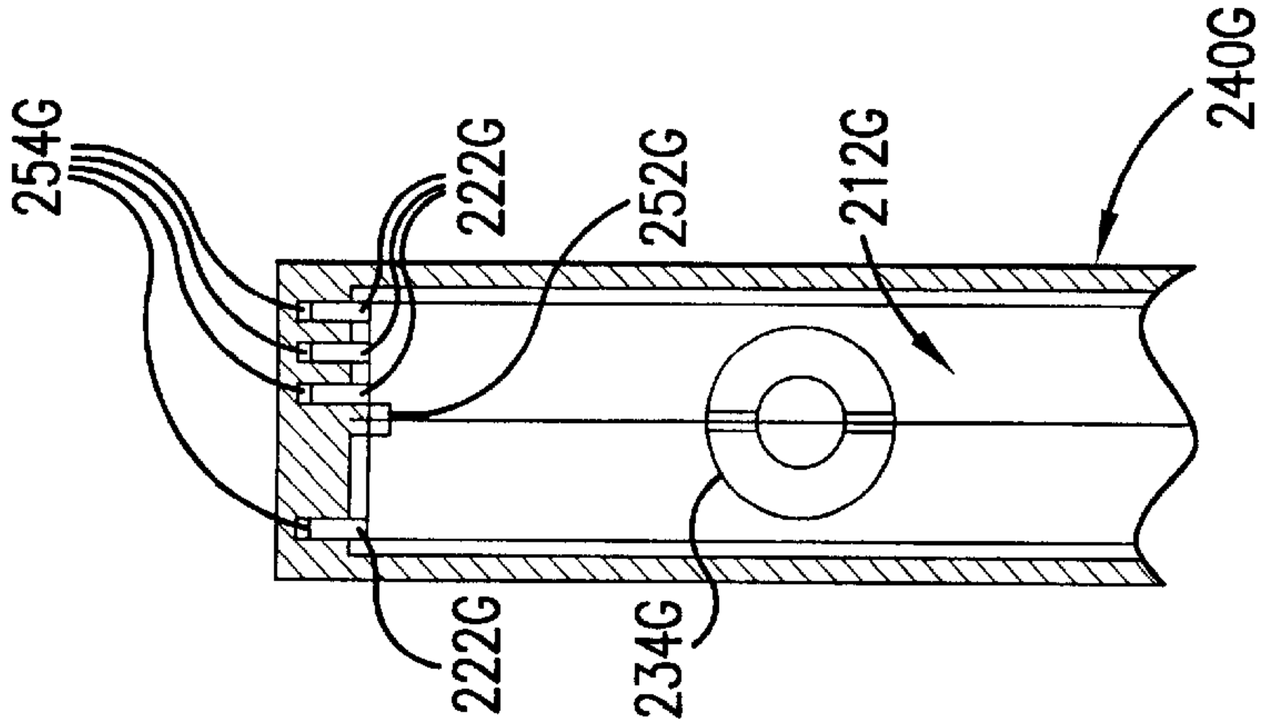

FIG.11G

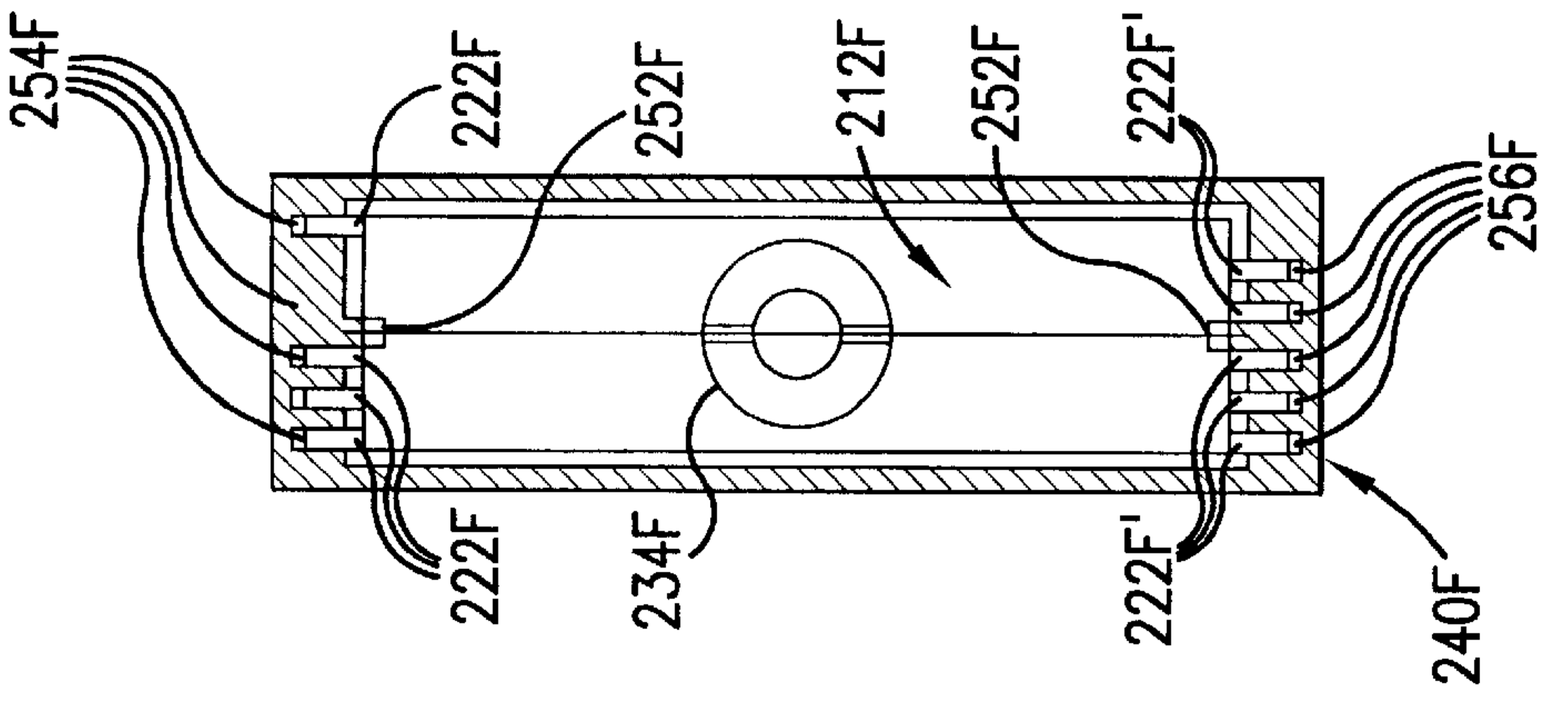

FIG.11F

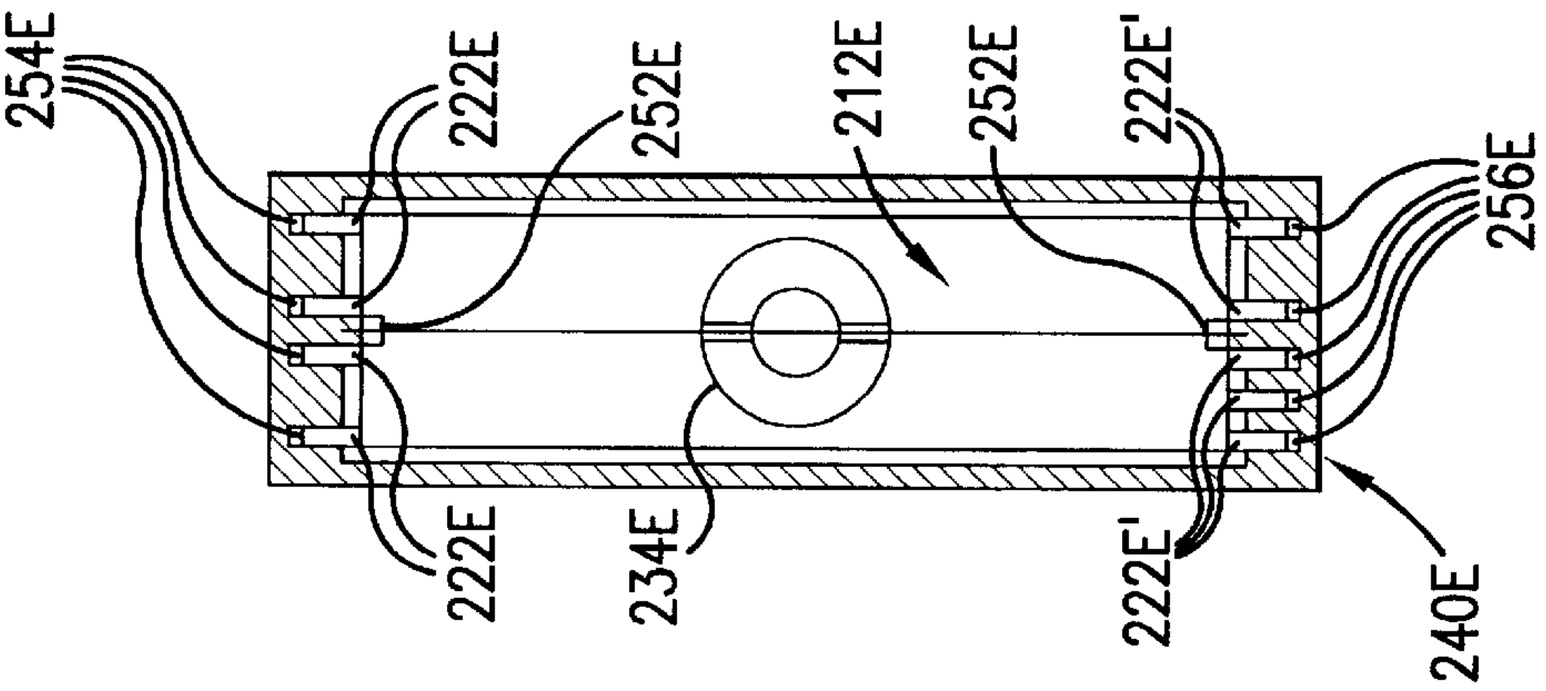

FIG.11E

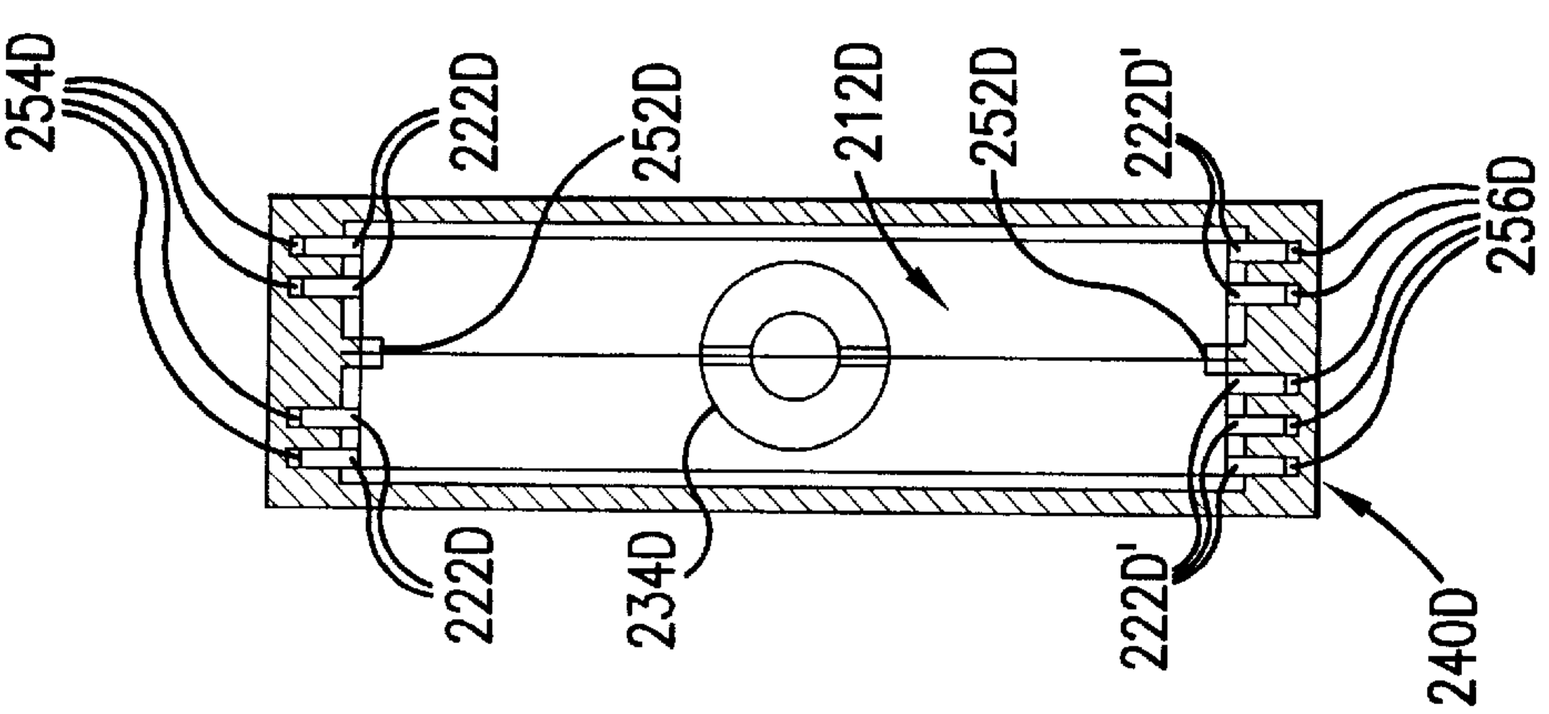

FIG.11D

METHOD AND APPARATUS FOR KEYING INK SUPPLY CONTAINERS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a a continuation-in-part of patent application Ser. No. 08/429,915, now U.S. Pat. No. 5,825,387 filed Apr. 27, 1995 entitled "Ink Supply for an Ink-Jet Printer", Attorney Docket Number 1094053-2 and is a continuation-in-part of patent application Ser. No. 08/566,521, filed Dec. 4, 1995 now abandoned entitled "Keying System For Ink Supply Containers" Attorney Docket Number 10950919-1 and is a continuation-in-part of patent application Ser. No. 08/671,134 filed Jun. 27, 1996 now abandoned entitled "Integrated Latching, Keying and Aligning Features for Ink Containers" Attorney Docket Number 10960399-1, now U.S. Pat. No. 5,588,142 issued Dec. 24, 1996. These applications are assigned to the assignee of the present invention and incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to a system for ensuring that a replaceable ink supply container is properly oriented when inserted into an ink-jet printer.

A typical ink-jet printer has a pen mounted to a carriage which is moved back and forth over a printing surface, such as a piece of paper. The pen carries a print head. As the print head passes over appropriate locations on the printing surface, a control system activates ink jets on the print head to eject, or jet, ink drops onto the printing surface and form desired images and characters.

Some ink-jet printers use stationary ink supplies that are mounted away from the carriage and that supply ink to a refillable ink reservoir built into the pen. The ink may be supplied from the supply container to the pen through a tube that extends between the pen and the container.

Color ink-jet printers typically combine four ink colors to create a multitude of colors on the printing surface. Such printers can include a replaceable supply container for each color (typically black, cyan, yellow and magenta) used by the printer. A group of pens, each dedicated to a particular color, are mounted to the printer carriage. A separate ink delivery system for each color of ink is required.

Specifically, the entire path for one color of ink from its supply container to the pen and out the print head is dedicated for use by a single color of ink. Accordingly, a four-color ink-jet printer is configured to incorporate four discrete ink delivery systems, one for each color.

Some ink-jet printing systems provide for different classes or families of ink for use with different models of printers. For example, a printer designed to provide a very high quality print output may use ink having chemical and physical properties that are unlike the inks used with less-costly printer designs or families.

Contaminating one color ink with another, such as by introducing an ink of one color into the ink delivery system of another color, can ruin the color print quality. Moreover, directing the ink of one family into the delivery system of another family, can be disastrous for a printer. For example, if two black inks from different families were mixed together as a result of replacing one supply with the other, the mixture could react to form a precipitate and clog the ink delivery system, resulting in failure of the printer.

It is generally not a problem keeping inks of different colors and different ink families separated in printers that

make use of replaceable cartridges having an integrated printhead and ink storage container. Because the entire ink supply, printhead and ink conduit between the ink supply and printhead are replaced with the ink cartridge there is generally not a concern of ink of different colors or families mixing. In contrast, there is great opportunity for inks of different ink families or different ink colors to become intermixed in printers which make use of ink storage units that are replaceable separately from the printhead. Replacing the ink storage unit with an ink color or ink family that is different from the previous ink storage unit results in the mixing of ink from the replacement ink storage unit with ink remaining in the printhead and ink conduit from the previous ink storage unit. This intermixing of ink colors tends to produce unpredictable colors reducing the quality of output images. In addition, the mixing of ink families can result in chemical interactions between the residual ink and replacement ink which can result in a precipitate which can block the ink passages or result in unpredictable performance of the printhead.

There is an ever present need for systems for insuring that ink containers having the proper ink parameters are correctly inserted into the ink jet printer. These systems should insure that the ink container is properly aligned so that proper fluid interconnect is provided between the ink container and the printhead. In addition, this system should provide some form of tactile feedback so that the user knows that the ink container is properly inserted into the printer. And finally, this system should provide some means for securing the ink container in the ink jet printer so that the ink container does not inadvertently become disconnected thereby causing ink spillage. This system should be cost effective and easily manufactured.

SUMMARY OF THE INVENTION

The present invention is an ink container for supplying ink having proper ink parameters to an ink container receiving station. The ink container includes a first feature indicative of ink family associated with the ink container and a second feature indicative of ink color associated with the ink container.

Another aspect of the present invention is where the ink container includes a shell and a cap, the cap is attachable to the shell and wherein each of the first and second features are attached to the cap.

In one preferred embodiment the first and second features are latch features. The latch features are configured for engaging ink container receiving station latch surfaces, for securely mounting ink containers having proper ink parameters to the ink container receiving station. In this preferred embodiment the first latch feature is a first plurality of tabs and the second latch feature is a second plurality of tabs, spaced from the first plurality of tabs.

Another aspect of the present invention is an ink container receiving station for receiving ink containers having proper ink parameters. The ink container receiving station includes a latching mechanism configured for engaging corresponding ink container latching features and securing ink containers to the supply station. The ink container receiving station includes a keying system component to define, in conjunction with ink container latch features, ink containers having proper ink parameters.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of an ink supply container that carries a component of a preferred embodiment of the keying system of the present invention.

FIG. **2** is an exploded perspective view of the ink supply container of FIG. **1**.

FIGS. **3**A–**3**D are bottom views of the supply container caps showing various key and keyway components of a preferred embodiment of the keying system of the present invention.

FIG. **4** is a perspective view of part of a printer docking station that includes another component of a preferred embodiment of the keying system of the present invention.

FIG. **5** is a top partial view of one wall of the docking station detailing part of the keying system of the present invention.

FIG. **6** shows the ink supply of FIG. **1** being inserted into a docking bay of a docking station.

FIG. **7** is a cross sectional view showing the ink supply of FIG. **1** fully inserted into the docking bay.

FIG. **8** is an exploded view of an alternative ink supply container which includes the latch features of the present invention which are indicative of ink parameters.

FIG. **9** is a perspective view of an ink container receiving station for receiving the ink container shown in FIG. **8**.

FIG. **10** is the ink container of FIG. **8** shown in engagement with the ink container receiving station of the present invention shown in partial cross section.

FIG. **11**A–**11**G are bottom views of ink containers of FIG. **8** showing various latching and keying components of a preferred embodiment of the keying system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

One embodiment of an ink supply container that carries a component of the keying system of the present invention is illustrated in FIGS. **1** and **2** as reference numeral **20**. The ink supply container **20** (occasionally referred to merely as ink "supply") has a chassis **22** that carries an ink reservoir **24** for containing ink. The chassis also carries a pump **26**, and a fluid outlet **28**. The chassis **22** fits within the lower open end of a hard protective shell **30**. A cap **32** is affixed to the lower end of the shell. The cap **32** is provided with an aperture **34** to allow access to the pump **26** and an aperture **36** to allow access to the fluid outlet **28**.

The ink supply **20** is inserted into the appropriate bay **38** of a docking station **132** of an ink-jet printer, as illustrated in FIGS. **6**–**7** (and described more fully below). Upon insertion of the ink supply **20**, an actuator **40** within the docking bay **38** is brought into contact with the pump **26** through aperture **34**. In addition, a fluid inlet **42** within the docking bay **38** is coupled to the container fluid outlet **28** through aperture **36**, thereby to create an ink delivery path from the ink supply **20** to the corresponding pen on the printer carriage. Operation of the actuator **40** causes the pump **26** to draw ink from the reservoir and deliver the ink through the fluid outlet **28** and the fluid inlet **42** to the ink-jet pen through a tube, as discussed below.

Upon depletion of the ink from the reservoir **24**, or for any other reason, the ink supply **20** can be easily removed from the docking bay **38**. Upon removal, the fluid outlet **28** on the container and the fluid inlet **42** of the docking station close to prevent any residual ink from leaking into the printer or onto the user. The ink supply container may then be discarded or stored for reinstallation at a later time. In this manner, the ink supply **20** provides a user of an ink jet printer a simple, economical way to provide a reliable, and easily replaceable supply of ink to an ink-jet printer.

As illustrated in FIGS. **2** and **7**, the chassis **22** has a main body **44**. Extending upward from the top of the chassis body **44** is a frame **46** which helps define and support the ink reservoir **24**. In the illustrated embodiment, the frame **46** defines a generally square reservoir **24**. Each side of the frame **46** is provided with a face **48** to which a sheet of plastic **50** is attached to enclose the sides of the reservoir **24**. The illustrated plastic sheet is flexible to allow the volume of the reservoir to diminish as ink is depleted from the reservoir. This helps to allow withdrawal and use of all of the ink within the reservoir by minimizing the amount of backpressure created as ink is depleted from the reservoir. The illustrated ink supply **20**, is intended to contain about 30 cubic centimeters of ink when full.

In the illustrated embodiment, the plastic sheets **50** are heat staked to the faces **48** of the frame in a manner well known to those in the art. The plastic sheets **50** are, in the illustrated embodiment, multi-ply sheets having a an outer layer of low density polyethylene, a layer of adhesive, a layer of metallized polyethylene terephthalate, a layer of adhesive, a second layer of metallized polyethylene terephthalate, a layer of adhesive, and an inner layer of low density polyethylene. The layers of low density polyethylene are about 0.0005 inches thick and the metallized polyethylene terephthalate is about 0.00048 inches thick. The low density polyethylene on the inner and outer sides of the plastic sheets can be easily heat staked to the frame while the double layer of metallized polyethylene terephthalate provides a robust barrier against vapor loss and leakage. Of course, in other embodiments, different materials, alternative methods of attaching the plastic sheets to the frame, or other types of reservoirs might be used.

The body **44** of the chassis **22**, as seen in FIGS. **2** and **7**, is provided with a fill port **52** for filling the reservoir **24**. After filling the reservoir, a spherical plug **54** is inserted into the fill port **52** to prevent the escape of ink through the fill port. In the illustrated embodiment, the plug is a polypropylene ball that is press fit into the fill port.

The pump **26** on the chassis **22** serves to pump ink from the reservoir and supply it to the printer via the fluid outlet **28**. In the illustrated embodiment, the pump **26** includes a pump chamber **56** that is integrally formed with the chassis **22**. The pump chamber is defined by a skirt-like wall **58** which extends downwardly from the body **44** of the chassis **22**.

A pump inlet **60** is formed at the top of the chamber **56** to allow fluid communication between the chamber **56** and the ink reservoir **24**. A pump outlet **62** through which ink may be expelled from the chamber **56** is also provided. A valve **64** is positioned within the pump inlet **60**. The valve **64** allows the flow of ink from the ink reservoir **24** into the chamber **56** but limits the flow of ink from the chamber **56** back into the ink reservoir **24**. In this way, when the chamber is depressurized, ink may be drawn from the ink reservoir, through the pump inlet and into the chamber. When the chamber is pressurized, ink within the chamber may be expelled through the pump outlet.

In the illustrated embodiment, the valve **64** is a one-way flapper valve positioned at the bottom of the pump inlet. The valve **64** is a rectangular piece of flexible material positioned over the bottom of the pump inlet **60** and heat staked to the chassis **22** at the midpoints of its short sides (the heat staked areas are darkened in FIG. **7**). When the pressure within the chamber drops sufficiently below that in the reservoir, the unstaked sides of the valve each flex downward to allow the flow of ink around the valve **64**, through the pump inlet **60** and into the chamber **56**.

A flexible diaphragm **66** encloses the bottom of the chamber **56**. The diaphragm **66** is slightly larger than the opening at the bottom of the chamber **56** and is sealed around the bottom edge of the wall **58**. The excess material in the oversized diaphragm allows the diaphragm to flex up and down to vary the volume within the chamber. In the illustrated ink supply, displacement of the diaphragm allows the volume of the chamber **56** to be varied by about 0.7 cubic centimeters. The fully expanded volume of the illustrated chamber **56** is between about 2.2 and 2.5 cubic centimeters.

A pressure plate **68** and a spring **70** are positioned within the chamber **56**. The pressure plate **68** is positioned within the chamber **56** with the lower face **72** adjacent the flexible diaphragm **66**. The upper end of the spring **70**, which is stainless steel in the illustrated embodiment, is retained on a spike **82** formed in the chassis and the lower end of the spring **70** is retained on the spike **78** on the pressure plate **68**. In this manner, the spring biases the pressure plate downward against the diaphragm to increase the volume of the chamber.

A conduit **84** joins the pump outlet **62** to the fluid outlet **28**. In the illustrated embodiment, the top wall of the conduit **84** is formed by the lower member of the frame **46**, the bottom wall is formed by the body **44** of the chassis, one side is enclosed by a portion of the chassis and the other side is enclosed by a portion of one of the plastic sheets.

As illustrated in FIGS. **2** and **7**, the fluid outlet **28** is housed within a hollow cylindrical boss **99** that extends downward from the chassis **22**. The top of the boss **99** opens into the conduit **84** to allow ink to flow from the conduit into the fluid outlet. A spring **100** and sealing ball **102** are positioned within the boss **99** and are held in place by a compliant septum **104** and a crimp cover **106**. The septum **104** is inserted into the boss **99** and compresses the spring **100** slightly so that the spring biases the sealing ball **102** against the septum **104** to form a seal. The crimp cover **106** fits over the septum **104** and engages an annular projection **108** on the boss **99** to hold the entire assembly in place.

In the illustrated embodiment, both the spring **100** and the ball **102** are stainless steel. The sealing ball **102** is sized such that it can move freely within the boss **99** and allow the flow of ink around the ball when it is not in the sealing position. The septum **104** is formed of polyisoprene rubber and has a concave bottom to receive a portion of the ball **102** to form a secure seal. The septum **104** is provided with a slit **110** so that it may be easily pierced without tearing or coring. The slit is normally closed. A hole **112** is provided so that the crimp cover **106** does not interfere with the piercing of the septum **104**.

With the pump **26** and fluid outlet **28** in place, the ink reservoir **24** can be filled with ink. To fill the ink supply **24**, ink can be injected through the fill port **52**. As ink is being introduced into the reservoir, a needle (not shown) can be inserted through the slit **110** in the septum **104** to depress the sealing ball **102** and allow the escape of any air from within the reservoir.

Of course, there are a variety of other methods which might also be used to fill the present ink supply. In some instances, it may be desirable to flush the entire ink supply with carbon dioxide prior to filling it with ink. In this way, any gas trapped within the ink supply during the filling process will be carbon dioxide, not air. This may be preferable because carbon dioxide may dissolve in some inks while air may not. In general, it is preferable to remove as much gas from the ink supply as possible so that bubbles and the like do not enter the print head or the trailing tube. To this end, it may also be preferable to use degassed ink to further avoid the creation or presence of bubbles in the ink supply.

Although the ink reservoir **24** provides an ideal way to contain ink, it may be easily punctured or ruptured and may allow a small amount of water loss from the ink. Accordingly, to protect the reservoir **24** and to limit water loss, the reservoir **24** is enclosed within the protective shell **30**. In the illustrated embodiment, the shell **30** is made of polypropylene. A thickness of about one millimeter has been found to provide robust protection and to prevent unacceptable water loss from the ink. However, the material and thickness of the shell may vary in other embodiments.

The top of the shell **30** has contoured gripping surfaces **114** (FIG. **6**) that are shaped and textured to allow a user to easily grip and manipulate the ink supply **20**. A vertical rib **116** having a detent **118** formed near its lower end projects laterally from each side of the shell **30**. The base of the shell **30** is open to allow insertion of the chassis **22**. A stop **120** extends laterally outward from each side of wall **58** that defines the chamber **56** (FIG. **2**). These stops **120** abut the lower edge of the shell **30** when the chassis **22** is inserted.

After the reservoir is filled, the protective cap **32** is fitted to the bottom of the shell **30** to maintain the chassis **22** in position. The cap **32** is provided with slots **128** which receive the stops **120** on the chassis **22**. In this manner, the stops are firmly secured between the cap and the shell to maintain the chassis in position. The cap aperture **34** allows access to the pump **26**, and aperture **36** allows access to the fluid outlet **28**. The cap **32** obscures the fill port **52**.

In the illustrated embodiment, the bottom of the shell **30** is provided with two circumferential grooves **122** which engage two circumferential ribs **124** formed on the cap **32** to secure the cap to the shell. Sonic welding or some other mechanism may also be desirable to more securely fix the cap to the shell. In addition, a label can be adhered to both the cap and the shell to more firmly secure them together. A pressure sensitive adhesive is used to adhere the label in a manner that prevents the label from being peeled off and to help secure the cap to the shell.

The attachment between the shell and the cap should, preferably, be snug enough to prevent accidental separation of the cap from the shell and to resist the flow of ink from the shell should the ink reservoir develop a leak. However, it is also desirable that the attachment allow the slow ingress of air into the shell as ink is depleted from the reservoir to maintain the pressure inside the shell generally the same as the ambient pressure. Otherwise, a negative pressure may develop inside the shell and inhibit the flow of ink from the reservoir. The ingress of air should be limited, however, in order to maintain a high humidity within the shell and minimize water loss from the ink.

In the illustrated embodiment, the shell **12** and the flexible reservoir **14** which it contains have the capacity to hold approximately thirty cubic centimeters of ink. The shell is approximately 73 millimeters wide, 15 millimeters thick, and 60 millimeters high. Of course, other dimensions and shapes can also be used depending on the particular needs of a given printer.

The shell **30** is substantially symmetrical about is vertical central axis. Accordingly, the shell may be joined with the cap in either of two orientations of the shell, thereby simplifying the container assembly process.

In accordance with the present invention, it is contemplated that the components of the ink supply container, except for the protective cap **32**, may be used to contain any of a number of different types of ink. One can divide types

of ink, for example, into two subcategories: family and color. A family of ink refers to the particular chemical and physical properties of the ink, such as its viscosity or solubility in water. Ink-jet pens and print heads that are designed to work with ink of a particular family will malfunction if ink of a different family is used. The ink color relates to one of four colors that are typically used in color printing and combined on the printing medium to yield the sought-after color output. In this regard, the ink delivery system for providing ink to the print head is limited to use with only one color and, therefore, must not be contaminated with ink of another color.

The protective cap **32** of the present invention includes features formed thereon to provide indicia of the particular single family and color of the ink contained in the reservoir. Similar features are provided in the docking station bays. These features on the ink container and in the docking station bays are the primary components of a system that prevents insertion of any ink containers into a particular bay, except for the single ink supply container that has a cap bearing the appropriate features for mating with corresponding features of the particular bay.

In accordance with the present invention, one end of the cap **32** is provided with features comprising projecting keys **130** that can identify the family of ink contained within the ink supply. For example, if the ink supply is filled with ink suited for use only with a particular printer or family of printers, a cap having keys of a selected number and spacing (in the illustrated embodiment, three evenly spaced keys **130** are shown) for indicating that ink family is contained in the supply. The other end of the cap is provided with a feature, a keyway **131**, that is indicative of a certain color of ink, such as cyan, magenta, etc. As will be explained below, the docking station in the printer carries features that mate with those on a cap to control the insertion of the containers into the station.

It is notable here that the chassis **22** and shell **30** can be manufactured, assembled and stored without regard to the particular type of ink they will contain. Then, after the ink reservoir is filled, a cap bearing features indicative of the particular ink type within the reservoir is attached to the shell. This allows for manufacturing economies because a supply of empty shells and chassis can be stored in inventory. When there is a demand for a particular type of ink, that ink can be introduced into the ink supply and an appropriate cap fixed to the ink supply. Thus, this scheme reduces the need to maintain high inventories of ink supplies containing every type of ink.

Alternative or supplementary ink content indicia may be incorporated into the cap. For example, when the ink supply is filled with a particular color of ink, a cap that is colored to match that color may be used. The color of the cap may also be used to indicate the family of ink contained within the ink supply.

The illustrated ink supply **20** is ideally suited for insertion into a docking station **132** like that illustrated in FIGS. **4–7**. The docking station **132** illustrated in FIG. **4**, is intended for use with a color printer. Accordingly, it has four side-by-side docking bays **38**, each of which can receive one ink supply container **20** of a different color. The structure of the illustrated ink supply allows for the supply to be relatively narrow in width. This allows for four ink supplies to be arranged side-by-side in a compact docking station without unduly increasing the "footprint" of the printer.

The docking bays **38** reside between opposing walls **134**, **136** of the station. Each wall respectively defines four inwardly facing vertical channels **138***a–d*, **140***a–d*. Each bay **38** (the upper boundary of one bay is shown in dashed lines in FIGS. **4–6**) receives one ink supply **20**.

A leaf spring **142** having an engagement prong **144** is positioned within the lower portion of each channel **138***a–d*, **140***a–d*. The engagement prong **144** of each leaf spring **142** extends inwardly into the docking bay **38** and is biased inward by the leaf spring.

Each of the channels **138***a–d* formed in one wall **134** of the station (for convenience referred to as the left wall) is shaped to define features that mate with a keyway **131** formed in the protective cap **32**. FIG. **5** best illustrates the configuration of the features in the left wall **134**, where the individual channels **138***a–d* each have discrete keying characteristics.

Turning to an exemplary channel **138***d* in the left wall **134**, it is seen that channel **138***d* has a protruding key **133** defined between its sidewalls **135**. With reference to FIG. **6**, the protruding key **133** is a generally elongated member extending in the vertical direction between the parallel side walls **135** of the channel **138***d*. In a preferred embodiment, the key **133** is in two parts: an upper part that is located at the upper end of the wall **134**, and a lower part that extends from the bottom of the wall **134** to a location just beneath the prong **144** that resides in the channel **138***d*.

The thickness (measured vertically in FIG. **5**) of the key **133**, and the spacing of that key between the sidewalls **135** of the channel **138***d*, is established to mate with a keyway **131** formed in the end of a particular protective cap **32**. In this regard, attention is directed to FIG. **3**D, which is a bottom view of the cap **32** depicted in FIG. **1**. That cap is configured on one end (the left end in FIG. **3**D) so that the width of that end part between the sidewalls **139** is just slightly less than the space between the sidewalls **135** of the channel **138***d*. Moreover, the width of the keyway **131** is just slightly wider than the thickness of the key **133** in that channel **138***d*. Put another way, the configuration of the cap end illustrated in FIG. **3**D is essentially the mirror image of the configuration of channel **138***d* (FIG. **3**D is a bottom view and FIG. **5** is a top view). Accordingly, the left end of the version of the cap **32** shown in FIG. **3**D will mate with, and only with, the channel **138***d* in the leftwall **134**.

The right end of the cap, as mentioned earlier, includes three evenly spaced projecting keys **130** that may be indicative of a particular family of ink used with the illustrated docking bay. The channels **140***a–d* in the wall **136** of the docking station are constructed at their tops and bottoms (see FIG. **4**) to define three evenly spaced apart keyways **143** that mate with the family keys **130** on the cap. Specifically, the keyways **143** are defined as the spaces between upper and lower protrusions extending between the sidewalls of the channels **140***a–d*. Like the keys **133** in the opposing wall **134**, these protrusions are in two parts, at the top and bottom of the channels, as shown in FIG. **4**.

Turning to FIGS. **3**A–C and FIG. **5**, it will be appreciated that, with the foregoing in mind, the configurations of the other channels **138***a–c* in the left wall **124** of the docking station define features that will mate only the container caps that have correspondingly shaped features on the associated end of the caps. For example, the end of the cap depicted in FIG. **3**A (for reference called the "black ink" cap) is constructed so that the gap between the sidewalls **139** of that end is relatively narrower than that dimension of other caps. The end of the black ink cap (FIG. **3**A) fits snugly within a correspondingly narrow channel **138***a* in the left wall **134** of the docking station. The black ink cap does not include a

keyway in the end of that cap **32**, and the channel **138***a* does not include a distinct key.

The ends of the caps depicted in FIGS. **3**B and **3**C illustrate alternative arrangements of cap configurations that include keyways **131** located and sized for mating with only one of the channels **138***b* or **138***c*, respectively.

It is contemplated that more than just four different caps, associated with four different colors, can be employed with the keying system of the present invention. In this regard, the width of the associated end of the cap and the location of keyways on the cap (and keys in the docking bay channels) may be designed in any of a multitude of configurations, provided that the configuration for a particular cap is unique to a pen color, and that the keying system permits the fluid outlet **28** of the supply **20** and the pump **26** to respectively align with the fluid inlet **42** and actuator **40** of the docking bay.

In addition to controlling insertion of a particular ink container into its corresponding, mating, bay, it will be appreciated that the above-described key features also serve to guide movement of the container into and out of the bay. In this regard, the vertical length of the keys and keyways are selected so that as the container is moved into the bay the container is limited to sliding translational motion to facilitate precise interconnection between the fluid outlet **28** and fluid inlet **42**.

As illustrated in FIGS. **6** and **7**, the upper end of each actuator **40** extends upward through the aperture **148** in the base plate **146** of the station **132** and into the docking bay **38**. The lower portion of the actuator **40** is positioned below the base plate and is pivotably coupled to one end of a lever **152** which is supported on a pivot point **154**. The other end of the lever **152** is biased downward by a compression spring (not shown). In this manner, the force of the compression spring urges the actuator **40** upward. A cam **158** mounted on a rotatable shaft **160** is positioned such that rotation of the shaft to an engaged position causes the cam to overcome the force of the compression spring and move the actuator **40** downward. Movement of the actuator causes the pump **26** to draw ink from the reservoir **24** and supply it through the fluid outlet **28** and the fluid inlet **42** to the printer.

As seen in FIG. **7**, the fluid inlet **42** is positioned within the housing **150** carried on the base plate **146**. The illustrated fluid inlet **42** includes an upwardly extending needle **162** having a closed blunt upper end **164**, a blind bore **166** and a lateral hole **168** near the blunt end. A trailing tube (not shown) is connected to the lower end of the needle **162** such that the blind bore **166** is in fluid communication therewith. The trailing tube (not shown) leads to a print head (not shown).

A sliding collar **170** surrounds the needle **162** and is biased upwardly by a spring **172**. The sliding collar **170** has a compliant sealing portion **174** with an exposed upper surface **176** and a lower surface **178** in direct contact with the spring **172**. In addition, the illustrated sliding collar includes a substantially rigid portion **180** extending downwardly to partially house the spring **172**. An annular stop **182** extends outward from the lower edge of the substantially rigid portion **180**. The annular stop **182** is positioned beneath the base plate **146** such that it abuts the base plate to limit upward travel of the sliding collar **170** and define an upper position of the sliding collar on the needle **162**. In the upper position, the lateral hole **168** is surrounded by the sealing portion **174** of the collar to seal the lateral hole, and the blunt end **164** of the needle is generally even with the upper surface **176** of the collar.

To install an ink supply **20** within a docking bay **38**, a user can simply place the lower end of the mating ink supply container between the opposing walls **134** and **136** that define a mating bay **38** (FIG. **6**). The ink supply is then pushed downward into the installed position, shown in FIG. **7**, in which the bottom of the cap **32** abuts the base plate **146**. As the ink supply is pushed downward, the fluid outlet **28** and fluid inlet **42** automatically engage and open to form a path for fluid flow from the ink supply to the printer. Once the supply is installed, the actuator may enter the aperture **34** in the cap **32** to pressurize the pump.

Once in position, the engagement prongs **144** on each side of the docking station engage the detents **118** formed in the shell **30** to firmly hold the ink supply in place. The leaf springs **142**, which allow the engagement prongs to move outward during insertion of the ink supply, bias the engagement prongs inward to positively hold the ink supply in the installed position. Throughout the installation process and in the installed position, the edges of the ink supply **20** are captured within the vertical channels **138** and **140** which provide lateral support and stability to the ink supply. The above-described keying components formed in bottom parts of the channels **138***a–d* and **140***a–d* are configured to provide clearance for the detents **118** and the central vertical ribs **116** formed in each side of the shell. In a preferred embodiment, the depth (measured left-to-right in FIG. **5**) is sufficient to provide clearance for the detent **118** and rib **116**, which may protrude outwardly slightly farther than the end of the cap **32**. Similarly, the depth of the central one of the three keyways **143** in the right station wall **136** is sufficiently deep to provide clearance for the detent **118** and rib **116** on that side of the supply container.

To remove the ink supply **20**, a user simply grasps the ink supply, using the contoured gripping surfaces **114**, and pulls upward to overcome the force of the leaf springs **142**. Upon removal, the fluid outlet **28** and fluid inlet **42** automatically disconnect and reseal leaving little, if any, residual ink and the pump **26** is depressurized to reduce the possibility of any leakage from the ink supply.

This detailed description is set forth only for purposes of illustrating examples of the present invention and should not be considered to limit the scope thereof in any way. Clearly, numerous additions, substitutions, and other modifications can be made to the invention without departing from the scope of the invention which is defined in the appended claims and equivalents thereof.

FIG. **8** shows an alternative embodiment of the ink container **212** of the present invention for use with an ink jet printer having an ink jet printhead (not shown). The ink container **212** is similar to the ink supply or container **20** except that the ink container **212** does not provide a pressurized supply of ink to the printing system. Instead, ink container **212** provides a source of non-pressurized ink the the printing system.

The ink container **212** of the present invention is configured for insertion into an ink container receiving station mounted on the printer for ensuring ink containers having compatible ink parameters are properly inserted into the printer and properly secured to the printer. The ink container receiving station will be discussed in more detail with respect to FIG. **9**.

The ink container **212** includes housing members **214** and **216**, an ink bag **218**, and a fitment **220** for providing a fluid interconnect between the ink bag **218** and the printer (not shown). Also included in the ink container **212** are latch features **222** and **222'** which are the subject of this invention.

Latch features **222** and **222'** in conjunction with corresponding latch surfaces, as will be discussed with respect to FIG. **9**, secure the ink container **212** to the printer. In addition, the latch features **222** and **222'** provide keying features to prevent the insertion of ink containers having incompatible ink parameters. Finally, the latch features aid in the guiding and aligning of ink containers during the insertion of the ink containers into the ink container receiving station on the printer.

One aspect of latch features **222** and **222'** of the present invention are to identify ink parameters of ink within the ink container **212**. The latch features **222** and **222'** are capable of identifying a large number of different ink parameters. These ink parameters include ink color and ink family, to name a few. The ink family is indicative of the chemical and physical properties of the ink formulation within the ink container **212**. Ink formulations specify such ink parameters as solubility in water, waterfastness of the ink, ultraviolet stability of the ink etc. It is crucial that only ink containers having compatible ink parameters be installed in the printer. If incompatible ink containers are installed then the ink in the container will combine with residual ink in the printhead resulting in a degradation in the output image quality.

The latch features **222** and **222'** in addition to identifying ink parameters also provide guiding and aligning features for inserting the ink container **212** into the ink container receiving station on the ink jet printer. The guiding and aligning features allow the user to insert the ink container **212** to make fluid connection with the printer without having to visually align the fluid interconnects. The user, therefore, need only insert the ink container **212**, and if it is compatible, then the latch features **222** and **222'** of the present invention will allow the ink container **212** to be inserted. During insertion, the latch features **222** and **222'** align and guide the ink container **212** into the printer. An important aspect of the present invention is that the latch features **222** and **222'** align the container **212** such that a fluid interconnection is made between the ink container **212** and the printer.

Another aspect of the present invention is that the latch features **222** and **222'** are used to secure the ink container **212** to the printer. The latch features **222** and **222'** together with latch surfaces located on the printer secure the ink container **212** to the printer. The latch surfaces will be discussed later with respect to FIG. **9**.

In the preferred embodiment the ink container **212** is made from identical housing members **214** and **216**. Use of identical housing members make it possible to form each of the housing members **214** and **216** using a single mold. The housing members are assembled as mirror images of each other. The use of a single mold for forming both of the housing members **214** and **216** reduces manufacturing costs as well as parts count. A reduction in parts count reduces costs associated with stocking and tracking of parts.

In this preferred embodiment housing member **216** includes fastening features **226** and **228** which interact with retaining features **230** and **232** on housing members **214** thereby forming a snap fastening of the housing members **214** and **216**. Because housing members **214** and **216** are mirror images of each other, housing member **214** also includes fastening features **226** and **228** (not shown) similar to housing member **216**. The fastening features of housing member **214** engage retaining features **230** and **232** on housing member **216** to fasten housing members **214** and **216** together. The use of fastening features **226** and **228** and retaining features **230** and **232** allow the fastening of housing members together without requiring additional parts thereby reducing manufacturing costs. In addition, the use of snap together housing members **214** and **216** allows the ink container **212** to be assembled relatively easily thereby reducing manufacturing cost.

Alternatively, the housing members **214** and **216** may be fastened using a wide variety of conventional fastening techniques such as bonding using an adhesive, one of a variety of welding techniques or fastening with a fastener such as a clip or screw.

In the preferred embodiment, the fitment **220** is attached to the ink bag in a conventional manner and the fitment **220** is secured in a fitment receiving portion **234** between the housing members **214** and **216**. The fitment **220** includes a fluid interconnect portion **236** which includes a septum and a ball valve. The fluid interconnect portion **236** interacts with a corresponding fluid interconnect portion on the printer for providing a fluid interconnect between the ink container **212** and the printer. In the preferred embodiment the fluid interconnect portion of the printer includes a needle portion which pierces the septum and opens the ball valve as the ink container **212** is inserted into the printer using latch members **222** and **222'**. Latch members **222** and **222'**guide the ink container to align the fluid interconnect portions of each of the ink containers **212** and the printer. Alternatively, the fluid interconnect may be a conventional fluid interconnect which provides a reliable fluid interconnect.

In another embodiment, the ink container **212** contains a frame having a flexible sheet attached to the frame such as disclosed in Ser. No. 08/566,521. Alternatively, the ink container **212** may be formed without an ink bag **218** inside. For this alternative embodiment the housing members **214** and **216** can be either formed separately and hermetically sealed together to form the ink container **212** or the housing members **214** and **216** can be molded as a unitary member to form the ink container **212**. In each of these embodiments, the housing members **214** and **216** form a hermetic seal or are a unitary member allowing ink to be placed directly in the housing members **214** and **216**.

FIG. **9** shows an ink container receiving station **240** for receiving the ink container **212** of the present invention. The ink container receiving station **240** is attached to the ink jet printer and is used in conjunction with the latch features **222** and **222'** on the ink container **212** to insure ink containers **212** having the proper ink parameters are inserted into the printer. In addition, the ink container receiving station **240** together with the latch features **222** and **222'** guide the ink container **212** during insertion into the printer to ensure the ink container fluid interconnect **236** properly aligns with the printer fluid interconnect. The ink container receiving station **240** includes a base **242** that is mounted to an ink jet printer **244**. The receiving station **240** also includes latch members **246** for engaging the latch features **222** and **222'** for securing the ink container **212** to the base **242**.

FIG. **10** shows the ink container **212** properly positioned in the ink container receiving station **240** such that latch members **246** engage each of the latch features **222** and **222'** to securely hold the ink container **212** in position in the ink container receiving station **240**. The ink container receiving station **240** together with the latch features **222** and **222'** guide the ink container **212** during insertion into the printer to mechanically align the ink container **212** with the latch members **246** for securing the ink container **212** to the printer. The latch features **222** and **222'** and the ink container receiving station **240** also provide a guiding and aligning function for ensuring proper electrical interconnection

between the ink container **212** and the printer. This electrical interconnect allows the exchange of a variety of information between the ink container **212** and printer such as ink level information provided by an electrical sensor or additional ink parameter or ink container **212** information that is stored in a storage device associated with the ink container **212**.

In the preferred embodiment the latch members **246** are spring clips which are shaped to engage each of the latch features **222** and **222**' to hold the ink container **212** in position on the ink container receiving station **240**. The latch members **246** have a non-latching position and a latching position. During insertion of the ink container **212**, a non-latching surface **248** of the latch members **246** are urged by the latch features **222** and **222**' into a non-latching position allowing the insertion of ink container **212**. Once the ink container **212** is properly positioned in the ink container receiving station **240**, as shown in FIG. **10**, the latch members **246** spring back into a latching position whereupon a latching surface **250** of the latch members **246** engages the latch features **222** and **222**' to secure the ink container **212** to the ink receiving station **240**.

Tactile feedback is provided to the user as the ink container **212** is inserted into the ink receiving station **240** identifying the ink container **212** is properly positioned. Tactile feedback is provided by both the configuration of the latch members **246** as well as the configuration of the latch features **222** and **222**'. As the ink container **212** is inserted, the latch members **246** provide a slight resistance as the non-engagement surfaces **248** engage the latch members **246** and urge the latch members **246** into the non-engagement position. Once the ink container **212** is properly positioned in the ink container receiving station **240**, the engagement surfaces **250** engage the latch features **222** and **222**' urging the ink container **212** towards the ink container receiving station **240** thereby providing tactile feedback to the user.

A pair of flanges **252** are formed on either side of the ink container receiving station **240**. The pair of flanges **252** are configured to engage slots **238** which are defined in sidewalls of the ink container **212** to aid in guiding and aligning the ink container **212** during insertion into the ink container receiving station **240**.

FIGS. **11**A–G show ink containers **212**A, **212**B, **212**C, **212**D, **212**E, **212**F, and **212**G each positioned within corresponding ink container receiving stations **240**A, **240**B, **240**C, **240**D, **240**E, **240**F, and **240**G, respectively. Similar numbering is used in FIGS. **11**A–G to represent features of FIGS. **8**–**10** that are similar. Each of the ink containers **212**A–G have a unique arrangement of latch features **222**A–G, and **222**'A–G, respectively, which are indicative of different ink parameters of ink contained within each of the ink containers **212**A–G. Each of the ink container receiving stations **240**A–G include corresponding latch feature slots **254**A–G which correspond to latch features **222**A–G, respectively, and latch feature slots **256**A–G which correspond to latch features **222**'A–G, respectively.

The latch features **222**A–G and **222**'A–G together with corresponding latch feature slots **254**A–G and **256**A–G cooperate to ensure proper ink containers **212**A–G are properly positioned in the ink container receiving station **240**A–G. The ink containers **212**A–G can only be inserted into ink container receiving stations **240**A–G having corresponding latch feature slots **254**A–G and **256**A–G that are configured for that particular ink parameter. For example, the latch feature receiving slots **254**B and **256**B are configured to receive ink container **212**B having ink parameters which are compatible. Ink containers **212**A,C,D,E,F,G containing inks having non-compatible ink parameters cannot be inserted into the ink container receiving station **240**B because the latch feature slots **254**B and **256**B do not correspond to the latch features **222**A,C,D,E,F,G and **222**'A, C,D,E,F,G.

In addition, the latch features **222**A–G and **222**'A–G together with corresponding latch feature slots **254**A–G and **256**A–G provide guiding and aligning features to ensure that the fluid interconnect **236** of the ink container **212** is properly aligned with the corresponding fluid interconnect on the printer. The fluid interconnect is mounted to the ink container **212**A–G by the fitment receiving portion **234**A–G, respectively.

An important feature of the latch features **222**A,C,D,E, F,G and **222**'A,C,D,E,F,G of the present invention is that in addition to the keying, guiding and aligning features previously discussed, these latch features are used in conjunction with the latch members **246** to secure the ink container **212** to the ink container receiving station **240**.

In the preferred embodiment the latch features **222** and **222**' are projecting tabs or keys which are evenly spaced. Each ink container **212** is initially manufactured to have an equal number of tabs or keys. The ink container **212** is then identified as having particular ink parameters by selectively removing tabs or keys to represent ink parameters contained therein. Alternatively, the ink containers may be initially formed having only the latch features or tabs required for the particular ink composition. By forming ink containers **212** to identify the ink parameter contained therein the step of selectively removing tabs or keys is eliminated.

The latch features **222** and **222**' may be arranged in other locations on the ink container provided a suitable latching mechanism is provided on the ink container receiving station **240** to engage these latch features. It is preferable the latch features be toward a leading edge of the ink container **212** as the container is inserted into the receiving station **240** to provide guiding and alignment of the container **212** and also prevent the container from insertion to the extent that fluid connection is made prior to the keying function.

In conclusion, the present invention provides an ink container having a single set of features which perform latching, keying and aligning functions during the insertion of the ink container into an ink container receiving station. Integrating each of these functions into a single set of features reduces the complexity of molds used to form the ink container which reduces the manufacturing costs. In addition, the reduction of the latching, keying, and aligning features to a single integrated feature set tends to produce a cleaner more aesthetically pleasing container.

What is claimed is:

1. An ink supply container for containing ink, the ink supply container configured for providing ink to an ink jet printing system, the ink supply container including:

a first feature indicative of an ink family of a plurality of ink families associated with ink contained in the container, the first feature extending in a first direction; and

a second feature different than and spaced from the first feature and extending in a second direction that is substantially opposite of the first direction, the second feature indicative of an ink color of a plurality of ink colors associated with ink in the container, wherein each of the first and second features are configured for engaging latch surfaces of the ink jet printing system for securely mounting the ink supply container to the ink jet printing system.

2. The ink supply container of claim 1 wherein the first feature comprises at least one keying portion that extends outwardly from the ink supply container and wherein the second feature comprises at least one keying portion that extends outwardly from the ink supply container.

3. The ink supply container of claim 1 further including a shell and a cap, the cap is attachable to the shell and wherein each of the first and second features are attached to the cap.

4. The ink supply container of claim 1 further comprising detent members formed in the shell adjacent to the first and second features.

5. The ink supply container of claim 1 wherein the ink family indicated by the first feature refers to particular physical properties of ink contained in the ink supply container.

6. The ink supply container of claim 5 wherein the particular physical properties of ink contained in the ink supply container is viscosity.

7. The ink supply container of claim 1 wherein the ink family indicated by the first feature refers to particular chemical properties of ink contained in the ink supply container.

8. The ink supply container of claim 7 wherein the particular chemical properties of ink contained in the ink supply container is solubility in water.

9. An ink supply container for containing ink, the ink supply container configured for providing ink to an ink jet printing system, the ink supply container including:

a first feature indicative of an ink family of a plurality of ink families associated with ink contained in the container, the first feature extending in a first direction;

a second feature spaced from the first feature and extending in a second direction that is substantially opposite of the first direction, the second feature indicative of an ink color of a plurality of ink colors associated with ink in the container;

a reservoir;

a variable volume chamber;

a valve interposed between the reservoir and the chamber to prevent the flow of ink from the chamber to the reservoir and allow the flow of ink from the reservoir to the chamber; and

a fluid outlet for establishing a fluid connection between the chamber and the printing system when the ink supply container is placed in the printing system, the fluid outlet being closed to prevent the flow of ink from the chamber when the ink supply container is not within the printing system, whereby when the volume of the chamber is increased as ink is drawn from the reservoir through the valve and into the chamber and when the volume of the chamber is decreased ink is forced from the chamber through the fluid outlet.

10. A method of manufacturing an ink supply container to include features indicative of the type of ink contained in the container, the ink supply container configured for insertion into an ink jet printing system, the method comprising the steps of:

providing a cap;

forming on the cap a first feature at a predetermined location on the cap, wherein the location is indicative of a particular one type of ink;

forming on the cap a second feature indicative of a family of ink to be contained in the container;

providing a shell for containing a reservoir of ink, the shell lacking any perceptible indicia of the type of ink to be contained in the reservoir; and

attaching the cap to a leading end of the shell, the leading end of the shell being that end of the shell first received by the printing system upon insertion of the ink supply container into the printing system.

11. The method of claim 10 wherein the attaching step includes covering a port, that is used for filling a reservoir of the shell, with the cap.

12. An ink container for supplying ink having proper ink parameters to an ink container receiving station having a latch surface, the ink container comprising:

a latch feature indicative of an ink parameter of a plurality of ink parameters, the latch feature being configured for engaging the latch surface of the ink container receiving station for securely mounting the ink container having proper ink parameters.

13. The ink container of claim 12 wherein the latch feature is a first and second latch feature and wherein the latch surface is a first and second latch surface with the first latch surface indicative of a first ink parameter and configured for engaging the first latch feature and the second latch surface indicative of a second ink parameter and configured for engaging the second latch feature.

14. The ink container of claim 13 wherein the first latch feature is different from the second latch feature.

15. The ink container of claim 13 wherein one of the first and second latch features are indicative of ink color associated with the ink container.

16. The ink container of claim 13 wherein one of the first and second latch features are indicative of ink compatibility associated with the ink container.

17. The ink container of claim 13 wherein the first latch feature is indicative of an ink color associated with the ink container and the second latching feature is indicative of an ink family associated with the ink container.

18. The ink container of claim 13 wherein each of the first and second latch features are a plurality of tabs extending from the ink container.

19. The ink container of claim 13 further including an ink container receiving station, the ink container receiving station including:

a first latching member configured for engaging corresponding ink container first latch features;

a second latching member configured for engaging corresponding ink container second latch features; and

a keying system component attached to the ink container receiving station to define, in conjunction with the first and second latch features, ink containers having proper ink parameters.

20. The ink container of claim 19 wherein the ink container receiving station is attached to an ink jet printer and ink provided by the ink container is utilized by the ink jet printer to form images on media.

21. An ink container receiving station for receiving ink containers having proper ink parameters, the ink container receiving station comprising:

a first latching member configured for engaging corresponding ink container first latch features disposed at ink container leading ends first received by the ink container receiving station;

a second latching member configured for engaging corresponding ink container second latch features disposed at the ink container leading ends first received by the ink container receiving station; and

a keying system component attached to the ink container receiving station to define, in conjunction with the first and second latch features ink containers having proper ink parameters.

22. The ink container receiving station for receiving ink containers of claim 21 wherein each of the first and second latching members are a spring clip.

23. The ink container receiving station for receiving ink containers of claim 21 wherein the keying system is a plurality of key slots for accepting ink containers having proper latch features.

24. A method for forming an ink container indicative of an ink parameter from a plurality of ink parameters, the method comprising:

forming first and second identical ink container portions, each ink container portion having a plurality of latch features;

assembling the ink container portions to form the ink container;

removing at least one of the plurality of latch features to form a non-symmetric ink container indicative of a selected ink parameter from a plurality of ink parameters.

25. A system for locating an ink container in an ink based printing device, the system comprising:

a plurality of ink containers, each of the plurality of ink containers having a plurality of latching features indicative of an ink parameter;

keying components integrated into the ink based printing device to guide the insertion of ink containers having corresponding latching features and to restrict the insertion of ink containers having latching features which correspond to non-compatible ink parameters; and

a latching mechanism configured for engaging the plurality of latching features for securing ink containers corresponding to keying components to the ink based printing device.

26. An ink container for use with a system of locating ink containers in an ink based printing device, the ink based printing device of the type having an ink container receiving station for receiving ink containers, the ink container comprising:

a latch feature configured for engaging ink container receiving station latch features, the ink container latch features being indicative of an ink parameter of a plurality of ink parameters;

a fluid interconnect attached to the ink container with only ink containers having ink parameters compatible with corresponding ink container receiving station ink parameters being configured for insertion wherein the latch feature received by corresponding ink container receiving station latch feature slots align the fluid interconnect with corresponding ink container receiving station fluid interconnects, with the ink container properly positioned in ink container receiving stations the latch feature is engaged by corresponding ink container receiving station latch features securing the ink container thereby establishing reliable inflow between the ink container and ink based printing devices.

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